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High School Teachers' Perspectives of Middle School Biomedical Science Career Exploration Programs

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This is to certify that the doctoral dissertation by

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has been found to be complete and satisfactory in all respects,
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Walden University
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Abstract

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MA, New Mexico Highlands University, 1999

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Dissertation Submitted in Partial Fulfillment

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Doctor of Philosophy

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Abstract

Biomedical sciences (BMS) are a common career pathway for U.S. Hispanic high school students interested in pursuing healthcare careers. Little was known about how middle school career exploration programs in science, technology, engineering, and mathematics motivate Hispanic students to continue pursuing BMS careers. The purpose of this basic qualitative study was to explore high school teachers' perspectives of how middle school BMS career exploration programs can motivate Hispanic students' interest in BMS careers. The study was grounded in Keller's attention, relevance, confidence and satisfaction motivation model. Thirteen high school BMS teachers, who have taught or are currently teaching the PLTW BMS curriculum, participated in semistructured interviews. Thematic analysis using a priori and open coding was conducted. Four themes emerged: student engagement in unique, immersive learning environments; connection of academic content to real-world applications; engagement in progressively scaffolded skills; and a greater sense of professional achievement and meaningful learning. Key findings were that middle school BMS career exploration promotes student engagement and helps students acquire industry skills while immersing them in real-world scenarios that can build a sense of inner pride and gratification. By understanding the motivational influence of BMS career exploration, middle school Hispanic students may experience improved engagement in and stronger motivation to pursue BMS careers resulting in positive social change over time.

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Dedication

This dissertation is for my husband, my children, my mom and dad, and my family. To my husband, Rick, whose resilience and strength are the reasons I am here today. You provided me with endless patience and support throughout this journey. Without you, none of this would be possible. You are my rock. I love you always. Infinite. To our children Nathanyal, Briana, and Marcus, who reminded me why I was working so hard and why the importance of hard work and education is so important. You are truly my inspiration. To my parents, who always believed in me before I believed in myself. Your support and sacrifices made this possible. To my mom who celebrated every success with me, supported me through every challenge, and taught me to be the person I am today. Without you and Rick, this dissertation would not have been completed. You continued to push me when I didn't want to be pushed and continued to encourage me when I didn't want to be encouraged. Thank you, Momma! To my siblings, Geno, Nikki, and Joey for your belief in my educational endeavors. Lastly, to my dad, we started this journey together and although you are not here right now, you continued to support me in spirit. I am who I am today because of you. This dissertation is for you. You and I did this together. I love you, Daddy!

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Chapter 1: Introduction to the Study

The biomedical sciences (BMS) are a combination of biology and medicine that focuses on the effects of healthcare of animals and humans. Research indicates that qualified Hispanic individuals, those obtaining an associate degree or higher, are not well represented in these careers (Chavez et al., 2019; Clayborne et al., 2021). BMS programs are categorized as a science, technology, engineering, and mathematics (STEM) field or STEM-adjacent field by the U.S. Bureau of Labor Statistics (BLS, 2025). Career exploration programs in middle and secondary school might provide the necessary exposure to postsecondary STEM career opportunities. However, career knowledge is limited among Hispanic students, as they have a declining interest in STEM, and do not appear to relate to STEM (Coleman, 2020).

Middle school can be an important time to promote career exploration and development, even though many school districts prioritize career education most extensively in the high school setting. As a result of early exposure, more students may have the knowledge, skills, and access they need to thrive in the rapidly evolving 21st-century job market (American School Counselor Association, n.d.; Grant et al., 2021). While many people regard STEM careers as unattractive options, research shows a link between early exposure to information about science and mathematics careers to long-term success in STEM (Mulvey et al., 2022). It is especially important for racial and ethnic minority students to have access to knowledge about careers in STEM and quality career advice as it has been suggested that they are more likely to develop interests in STEM careers (Ghazzawi et al., 2021).

Chapter 1 begins with a review of background literature informing the problem statement, the purpose of the study, and research questions. The conceptual framework used as a lens in this study is identified and justified. The nature of the study is explained in Chapter 1, and the essential definitions within the literature are shared. The chapter concludes with assumptions, scopes and delimitations, study limitations, and the study's significance.

Background

Career exploration normally begins in high school through a career pathway or a career technical education program. STEM careers, such as BMS and health care, are normally introduced to students through high school career exploration, career pathways, career academy models, and career technical education (CTE) programs (Chine & Larwin, 2022). Programs such as these are necessary to improve the motivation of students in high school because these career exploration models allow them to see the connections to what they are learning to a variety of options that they can continue to study as a career after high school (Ecton & Dougherty, 2022).

Many healthcare and BMS careers in a 21st century workforce requires a foundation in STEM related skills (Tello & Goode, 2023). Starting with the last year of elementary school through high school, students can foster a positive attitude and confidence in their abilities in STEM-healthcare subjects. However, they do not see themselves in those roles preventing them from developing STEM identities (Wong et al., 2022). Although there is a substantial effect that teachers and counselors can have on the performance of minority students in STEM, it is difficult to find research on the impact of

minority role models, especially those who are successful in STEM careers (Burt et al., 2023).

School districts in the United States do offer prebiomedical and premedical science programs that focus on innovative and rigorous academic career readiness instruction for elementary, middle, and high school underrepresented students (Brown et al., 2020). Biomedical Career Enrichment Programs (BCEPs) are rigorous programs that serve as a pipeline for students to provide support and encouragement as they continue to prepare for the BMS and healthcare workforce (Bhatt et al., 2020). In addition to supporting and encouraging students to pursue STEM fields, teachers can stimulate the initiation of such interests (Witzel et al., 2020). Identifying the need for career exploration program options gives students the opportunity to choose theme-based curricula taught by specially trained teachers (Chine & Larwin, 2022).

Career pathways are also a medium for teachers to build necessary relationships with their students while introducing and engaging students to prepare and motivate students in STEM-healthcare career areas. A career pathway focuses on fostering a sense of community among youth by building trusting, supportive relationships (Rocha et al., 2021). Teachers can then encourage students to explore STEM-healthcare-related topics and activities, giving them the confidence to explore these areas further. Finally, career pathways provide students with resources and information about careers in STEM which can help them make more informed choices (Witzel et al., 2020). Young people's career orientation is influenced by their communication with others and their experiences (Chine & Larwin, 2022). This study may fill a meaningful gap in the literature by sharing

insights into how middle school career exploration coursework or programs, such as BMS, can motivate Hispanic students to continue to pursue their interests in these career areas.

Problem Statement

The problem is that little is currently known about how middle school STEM career exploration programs can motivate Hispanic high school students to continue pursuing BMS career interests. Studies show that career awareness is limited among Hispanic students and there is a limited interest in STEM careers in high school (Rosenzweig & Chen, 2023;). Although Hispanic students are involved in a wide variety of in-school and out-of-school STEM hands-on activities, they do not see the apparent connection from what they are learning to STEM careers (Tello & Goode, 2023). Research shows that middle school career exploration and pathway programming is limited throughout the U.S. as access to inquiry-centered student learning is also rare for low-income and underrepresented students (Chavez et al., 2019; Kapon et al., 2023). Consequently, students can lose the desire to seek out or work towards a STEM career as early as middle school (Brown et al., 2020; Grant et al., 2021). Exposure to the BMS and healthcare careers while in middle school may be a crucial first step to influence Hispanic students' interests in STEM careers. Furthermore, the application of career exploration in BMS may initiate further discussions on how middle school education must involve more real-world teaching and learning.

There is limited research on the influence of middle school experiences in STEM career exploration that can encourage Hispanic students to pursue BMS careers. Current

research indicates that this problem is justified and necessary (Brown et al., 2020; Grant et al., 2021). Middle school Hispanic students will likely imagine themselves in the future through a practical career path, when their career identity becomes critical (Parada & Salmela-Aro, 2022).

Purpose of the Study

The purpose of this basic qualitative study was to explore high school teachers' perspectives of how middle school BMS career exploration programs can motivate Hispanic high school students' interest in BMS careers. High school teachers provided insight of high school Hispanic students motivation who were enrolled in their BMS career exploration programs and expressed interest in pursuing BMS career options.

Research Question

The following research question was used to address the problem and purpose of this study:

RQ: What are high school teachers' perspectives on how middle school STEM career exploration programs motivate Hispanic students' interest in BMS careers?

Conceptual Framework

The conceptual framework that informed this qualitative study is Keller's (1987) attention, relevance, confidence, and satisfaction (ARCS) motivation model. According to the ARCS model, instructional designers and instructors can create conditions that will motivate the learner to identify with and continue their interests in a subject area (Keller, 1987). Recognizing future career aspirations begins in middle school, a critical time for

young students, and is an important time when they begin to form their STEM interests and identities (Grant et al., 2021; Parada & Salmela-Aro, 2022).

Educators can improve student learning by designing and/or using motivational programs at appropriate stages of their learning (Kier & Blanchard, 2020; K. Li & Keller, 2018). The use of the ARCS model in this study helped to make sense of how BMS career exploration middle school coursework can motivate the movement and progression of student learning to encourage and build confidence in students' self-identification with BMS careers. To determine the influence of a middle school program, ARCS will be used as a lens to view high school BMS teacher perspectives of how the implementation of these programs could influence Hispanic students' motivation to explore BMS careers in high school and postsecondary.

A variety of learning environments and situations were examined in the framework of the ARCS model. However, this study concentrated on student-led learning environments, such as high school BMS career exploration courses and the motivation of students who might not be enthusiastic or see the relevance of some subjects (Chen et al., 2024). This framework was used to examine STEM career exploration coursework, such as the Project Lead the Way (PLTW) Biomedical Sciences (BMS) high school coursework, and how it motivated high school Hispanic students and encouraged them to continue to focus on BMS career pathways in high school and postsecondary. ARCS was used to construct interview questions that spoke to motivational elements of the PLTW BMS program and how those elements influenced high school Hispanic students'

motivation. The framework was used to determine how interview responses aligned with motivational elements of the program through data analysis.

Nature of the Study

I used a basic qualitative design for this study. According to Rubin and Rubin (2012), qualitative analysis requires attention to variation, to difference in emphasis, and to shades of meaning. This basic qualitative study entailed interviewing 12 to 18 BMS high school teachers. According to Ravitch and Carl (2016), rather than being a linear process, qualitative research is cyclical and constantly interconnected with each other. The invitation of the teacher participants for this study came from the assistance of an unofficial PLTW online teacher social media platforms. Selecting the participant group required understanding he goals that the research question presented as it related to the their background and their relationship with the research question presented (Ravitch & Carl, 2016). One-on-one interviews containing open-ended questions align with the purpose of this study. Data was analyzed using a priori codes of attention, relevance, confidence, and satisfaction (Keller, 1987) as the first level of coding and any emerging codes was addressed that was detected in the data.

Definitions

Biomedical sciences (BMS): An area of sciences rooted in the biological and medical fields that has its focus on animal and human health (Bankston et al., 2025).

Career academy: Known as a school within a school, this model connects students with peers and teachers to support social-emotional learning and academic

success, while connecting them with community partners to promote career readiness (Ecton & Dougherty, 2022).

Career development: It involves knowing oneself, exploring options, and making decisions that will influence one's career as well as training for jobs that match a person's personality, skills, and interests. (Williams, 2017).

Career exploration program: A program aimed at helping students gain career knowledge and self-awareness towards the working environment by solving problems, making decisions, and adapting their outlook towards specific careers and the challenges that go with them while exploring these careers in more depth (Oliveira & Araujo, 2021).

Career pathway: An integrated series of scaffolded educational courses developed to support students, many of whom are already employed, to assist them in improving their skills towards higher level careers that involve more advanced education and training. (Eyster & Gebrekristos, 2018).

Health science: A two-part applied science discipline consisting of research on health topics and the application of that knowledge to improve and to better understand the health of humans and animals and to cure diseases (Chester et al., 2020).

Hispanic: People of any race with roots in the Spanish-speaking countries of Central or South America, or another Spanish culture or origin (Mora, 2021).

Motivation: A driving force behind an action (Keller, 1987). In this study, students demonstrate motivation as measured by their willingness to move forward in their learning as they develop confidence in their self-identification with BMS careers.

Science, technology, engineering, and mathematics (STEM) *education*: An area of education that allows students to research and develop solutions to problems and construct interpretations and meaning of real-world scenarios in a student-centered environment that integrates STEM (English, 2017).

Assumptions

This study was based on a few assumptions related to qualitative research design. When we accept unexamined views and theories, we make assumptions. I assumed that the interview questions collected the required information to answer the research question and that the BMS teachers who participated in the study were open and honest with their responses (Rubin & Rubin, 2012). There was also an assumption that the teacher participants in this study had consistent experiences with career pathways, exploration, and PLTW BMS. This is a vital component because this study focuses on teachers' perspectives of the possible motivation of Hispanic students enrolled in their BMS career exploration courses. Lastly, it was assumed that the teachers recognized their students' motivations based on their past and present classroom experiences, and they were able to describe the effects of these experiences on their students' motivation. Questioning assumptions is crucial because it allows us to challenge and potentially correct misconceptions or biases. This practice encourages critical thinking and ensures that our beliefs and decisions are based on evidence and reason. Examining assumptions can achieve a deeper understanding and foster innovation and progress.

Scope and Delimitations

The scope of this study was based on specific study boundaries. One of the boundaries in this study, was exploring high school teachers' perspectives of middle school career exploration programs and whether these programs could motivate Hispanic students to want to pursue BMS career programming in high school and postsecondary. This study is confined by the limited number of middle schools who offer a BMS career exploration course to Hispanic high school students. Therefore, a focus on how high school BMS programs impact Hispanic students from the perspectives of the high school BMS teachers was the focus to understand the impact. Within the boundaries of the purpose of this study, a basic qualitative study approach was selected as the methodology.

The delimitation of this study included the selection of PLTW BMS teachers based on specific criteria. First, the study was limited to high school BMS teachers. I also only explored the perspectives of those BMS teachers who work with students who are identified as Hispanic and who have completed or currently enrolled in their BMS career exploration course. My decision to limit the focus on middle school BMS career exploration course or program was based on literature describing the need to diversify the healthcare career arena and how career exploration in middle school can gain the attention and confidence of Hispanic students to motivate them to pursue a healthcare career using the perspectives of BMS high school teachers (Tello & Goode, 2023).

These supported strategies aligned with the purpose of the study, the research question, and the problem, and the collection of the data (Patton, 2015). The use of

inclusion criteria and purposeful sampling supported the strategic focus on the selection and transferability of the study (Ravitch & Carl, 2016). This included detailed and rich descriptions of the BMS teacher participants who work with Hispanic students. The students must be currently enrolled in a BMS course or complete a minimum of one or more BMS courses in high school. Transferability was informed by using rich, detailed data and detailed descriptions (Merriam & Tisdell, 2016). The focus was on the perspectives of these teacher participants of how they perceived their Hispanic students as motivated to continue to pursue healthcare careers. By providing comprehensive context, I determined whether the findings were relevant and enhanced the usefulness of my research.

Limitations

Limitations are often created within a study's research design. As a basic qualitative research approach was used in my study, one limitation was my perspectives and biases as a researcher. I am a PLTW BMS teacher. My role as a BMS teacher creates a bias that could be a limitation within this study because I have taught middle school and high school BMS. To address this limitation, my school district was not included in the study. I also used peer debriefing strategies and inclusion of detailed data descriptions to help confirm the findings and reaffirm the validity of the research findings (Merriam & Tisdell, 2016).

A second limitation of the study was the number of high school teachers that currently teach BMS courses who have Hispanic students who are currently enrolled in their BMS courses or have completed one or more of the classes. This could have an

impact on the number of interviews acquired for this study. Participation validation strategies should be employed at multiple points in the study when striving for complexity and fidelity to participants' experiences (Ravitch & Carl, 2016). As the study's sample size was limited, it was unlikely transferable across course programs, but it was certainly achievable considering the variations in the course programs and grade levels.

A third limitation of the study was the use of an individual interview to capture the perspectives of the teachers who have Hispanic students. Using individual interviews may impact data analysis, as it sometimes may be difficult to capture the complete descriptive experience of their perceptions of individual Hispanic students' motivation (Merriam & Tisdell, 2016). To address this limitation, the study incorporated probing questions during the teacher interviews to encourage a broader range of perspectives and insights. The last limitation was the transferability of the findings that were gathered through this study. I focused on the perspectives of high school BMS teachers and their experiences with Hispanic students in their classes in relation to how a middle school BMS career exploration program could potentially motivate Hispanic students to pursue healthcare career options. This could make it difficult to establish and conclude the results of the study. To address this limitation, the study included a more diverse group of PLTW BMS teachers from various educational settings and areas.

Significance

This study is significant as it provided contributions to advancing knowledge of innovative practices, such as middle school career exploration coursework and programs,

to support career pathways in middle school. Considering the increasing numbers of Hispanic representation in the United States, using positive interventions earlier in school to support Hispanic students' motivation in STEM career fields is vital (Thomas & Larwin, 2023). This study also suggests equity-minded recruitment of minorities in career exploration and pathways during middle and high school.

This study filled a gap in the literature by sharing insights from high school BMS teachers' perspectives on how their Hispanic students who are currently taking or have completed a high school BMS course were motivated to pursue healthcare careers. Conclusions from the study can advise leaders of schools, school districts, and the medical community that understanding the perceptions and benefits of the middle school career exploration coursework, particularly in BMS, provides awareness that exposure to these careers in middle school is a critical first step. The goal of this study was to bridge the gap between traditional middle school electives and the need to explore more innovative approaches for preparing students for 21st-century learning. Moreover, this study may provide a framework for positive social change by understanding how early career exploration programs motivate Hispanic students to pursue careers in healthcare and BMS.

Summary

In this chapter, literature was summarized to identify a gap in knowledge focused on how middle school career exploration programs may motivate Hispanic students to pursue BMS or healthcare careers interests in high school and beyond. This study was conducted using the ARCS motivation model as a conceptual framework and a basic

qualitative design. Possible contributions to advance awareness and innovative practices and to clarify the potential implications of this study for positive social change were also discussed.

In Chapter 2, I describe the literature search strategies used in this study and a review of the conceptual framework. I also include an overview of the current literature that is related to diversifying healthcare careers by introducing BMS career exploration to middle school Hispanic students, and the implementation of BMS and healthcare career exploration as an in-school elective course or program in middle school, and real-world, problem-based learning use in middle school.

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Chapter 2: Literature Review

STEM-healthcare career knowledge can be limited among Hispanic middle school students which can result in a declining interest in STEM-healthcare careers. Exposure to middle school career exploration programs highlighting STEM career options appears to counter this decline (Albritton et al., 2020). The problem this study addressed is that little is currently known about how middle school STEM career exploration programs can motivate Hispanic students to continue pursuing BMS career interests. The purpose of this basic qualitative study was to explore high school teachers' perspectives of how middle school STEM career exploration programs can motivate Hispanic students' interest in BMS careers.

In Chapter 2, I validate the use of the ARCS model in this study as a conceptual framework. I highlight the importance of STEM-healthcare career programs and how they motivate students starting in middle school or earlier. I also present a review of the literature presenting STEM-healthcare career exploration and pathways as a curricular approach in middle school for Hispanic students. My examination of the literature also focused on the benefits associated with the STEM-healthcare career exploration and pathways approach that focused on students developing critical attitudes and beliefs that transform over time and across settings focused on BMS careers.

Literature Search Strategy

As I compiled this literature review, different strategies were taken into consideration. Preparation of this literature review was drawn upon various resources that included scholarly journals, reports, online documents, and transcripts from presentations

and interviews. It was noted that underrepresented minority students in authentic STEM-healthcare settings is critical. The underrepresentation of minority students appeared in many professional and scholarly prints and journals. Also, career exploration related to high schools appeared in several professional and scholarly prints and periodicals. There were also several professional and scholarly articles focused on STEM-healthcare out-of-school time programs that included summer enrichment and after-school programming for middle and high school students. The analysis of the literature is organized in the following manner: (a) lack of diversity in STEM, particularly in BMS, (b) overview of opportunities in authentic BMS settings for Hispanic students, (c) overview of BMS career pathways and how they are used in secondary education and the significance with career exploration in middle school.

A saturated literature review has been conducted using scholarly sources from published reports, books, and peer-reviewed journal articles. The scholarly publications were accessed from the databases ACM Digital Library, Directory of Open Access Journals, EBSCOhost, Education Source, ERIC, Google Scholar, SAGE Journals, Springer Link, Taylor and Francis Online, and Teacher Reference Center (TRC). The search terms were used in multiple combinations to ensure that articles related to this study from specific scholarly journals were collected and organized. The following search terms used to explore articles published about the topic of study included *Science, Technology, Engineering, and Mathematics, STEM, biomedical sciences, healthcare, careers, biomedical science careers, STEM careers, career exploration, career pathways, career academies, career technical education, CTE, middle school STEM, middle school*

math and science, middle school biomedical sciences, middle school career exploration, middle school career pathways, minorities, underrepresented minorities in healthcare, Hispanics, Hispanic in healthcare, minorities in healthcare, diversity in healthcare, diversifying healthcare, student perceptions of career exploration, career exploration implementation, career exploration implementation in middle school, minority student perceptions of biomedical sciences careers, minority student perceptions of healthcare careers, ARCS, ARCS motivational model, attention, relevance, confidence, satisfaction, Project Lead the Way, Project Lead the Way Biomedical Sciences, and *Project Lead the Way Gateway Medical Detectives,* and other synonyms of these terms.

After surveying each article searched, those articles appropriate for this study were saved and organized in a literature review matrix using Microsoft Excel, in a folder on the computer desktop, and in an open-source reference management software program. Most of the articles selected for this literature review were written within the last 5 years; however, there were some older materials used such as peer-reviewed articles, books, dissertations, and journals to assist with this study. The literature search encompasses many research journals and additional academic sources. I did cross-reference peer-reviewed articles focused on career exploration, career pathways, and CTE in high school and its influences on summer enrichment programs for middle school students.

Conceptual Framework

The conceptual framework grounding this study consists of Keller's (1979, 1987) ARCS model. This framework was my research map of how STEM career exploration

programs, such as PLTW Medical Detectives, might motivate Hispanic students to continue the pursuance of STEM-healthcare career areas as they transition into high school (Keller, 1987). Motivation is a key component of student behaviors and has a significant impact on their learning (K. Li & Keller, 2018). The ARCS model is not a behavior modification technique but simply a strategy that can be used in any learning environment (Keller, 1987). Although the model can be used in many different learning environments and situations, this study utilized the ARCS model to focus on how middle school career exploration can motivate Hispanic students in BMS using relevance while building confidence through hands-on experiences. The ARCS model is divided into four constructs: attention, relevance, confidence, and satisfaction. These constructs contribute to a student's potential and personal feelings of success and accomplishment in his or her learning.

The use of the ARCS model helped determine the qualities of BMS and healthcare career exploration coursework that motivates Hispanic students to continue exploring these career areas in high school and postsecondary. The conceptual framework served as a lens for examining how Hispanic students' participation in a high school BMS career exploration program can be a key factor for implementing middle school programming to grow the pipeline of Hispanics in BMS and health care. Context theory and the methods of study are connected through the conceptual framework bridging the gap between these contextualizing and mediating influences (Ravitch & Carl, 2016).

ARCS Model

Tolman and Lewin's expectancy-value theory forms the basis of the ARCS model, a theoretical foundation whose validation dates back more than 30 years (K. Li & Keller, 2018). The ARCS model was developed to focus on motivation to learn in relation to the instructional design and teaching strategies (Keller, 1983). Keller (1987) identifies four constructs in the ARCS model: attention, relevance, confidence, and satisfaction. These constructs are used to provide an explanation of why students may actively work to attain a goal (Keller, 2010b).

Attention refers to promoting student learning by keeping students engaged and curious. (Bacca et al., 2018). In this component, three categories are included: perceptual arousal, in which a surprise or uncertain situation is used to elicit attention; inquiry arousal, in which challenging questions or problems are offered; and variability, in which a variety of resources and teaching methods is used (Malik, 2014).

Relevance involves demonstrating the importance and applicability of the material to students' lives. This includes the students awareness of how their learning aligns with their interests (Chin et al., 2015). Relevance must be established by using language that students understand and is connected to what they are learning (Keller, 1987). This is connected to three strategies that Keller (1979) states as necessary to relevance including goal oriented, motive matching, and familiarity (Malik, 2014).

As a vital component of the ARCS model, confidence is defined as students' positive expectations formed during their learning process (K. Li & Keller, 2018). Motivating learners to reach a performance objective is often correlated with their

confidence level (Keller, 2016). The ability to succeed depends on the hands-on skills and support they receive. Keller offers confidence-building strategies that lead to student motivation including performance requirements, relevant opportunities, and self-mastery (Malik, 2014). The confidence that students build during their learning relates to the opportunities presented to them as they learn (Hiğde & Aktamış, 2022). Lastly, the confidence that students have developed through the satisfaction of their learning ensures that they receive positive reinforcement and recognition for their efforts and achievements (Keller, 1979, 1987; K. Li & Keller, 2018).

The final construct of the ARCS model, satisfaction, is the feeling of success as the students need to continue their learning (Keller, 1987, 2010a). Satisfaction is an indicator that there is a relationship between the outcomes of student learning and their expectations (Xueli et al., 2024). It provides learners with an extrinsic and intrinsic reinforcement for effort (Keller, 1987). According to Lee et al. (2021), efforts to improve middle school students' learning motivation leads to better academic performance. Motivating the learner is the pioneering factor in meaningful learning according to the definition of ARCS and motivation is the leading variable widely used in education (Xueli et al., 2024).

The four constructs of the ARCS model, as seen in Table 1, explain how they relate to Hispanic student motivation. Each construct can be addressed with different approaches, such as offering rewards, providing recognition, or creating a sense of ownership (Kahraman, 2022). Table 1 also emphasizes how each of the constructs help explore the how and why behind the motivation of students.

Table 1

ARCS Constructs: Explanations and Process Questions

Construct	Explanation	Process question
Attention	Catch attention of students, arouse curiosity to learn	What can I do to enhance the learning experience and make it more inspiring and enjoyable?
Relevance	Accommodating the needs of students Having a positive attitude towards the student	What value will this learning experience add to students?
Confidence	Helping students with what they believe Feeling that they can achieve and be in control of their success	How do I help students achieve success through education and how do I get them to control their success?
Satisfaction	Empowering success with rewards	What can I do to help students have an enjoyable and positive experience while helping students aspire to learn?

Note, Table 1 focuses on how the four main constructs (Keller, 1979) and the students' motivation to learn are connected to process questions.

Keller (1987) emphasized that creating an environment where students can foster their attention while continuing to learn is the true challenge. He proposed the use of a variety of strategies to keep students engaged and motivated. These include providing a clear structure, using visuals, and giving frequent feedback. Additionally, the learning process should be interactive, involving activities that allow students to be critical thinkers and apply what they have learned in the process (Feng & Tuan, 2005). Students are encouraged to stay engaged and motivated by using a variety of strategies, such as visual aids, explicit explanations, and frequent feedback (Kahraman, 2022). The ARCS model also encourages collaboration among students and encourages them to take

ownership of their learning while giving them opportunities to use critical thinking skills and problem-solving skills (K. Li & Keller, 2018).

ARCS Model in Previous Research

There have been many studies conducted using Keller's (1979, 1987) model as an approach for designing classroom lessons for instruction and a model to study student motivation to learning. Keller (2010a) mentions that it was a coincidence that led him to realize that there was a large gap in the literature regarding instructional design regarding learner motivation. Since ARCS has become more prominent in education and training that the application of ARCS is beneficial, noting "all these experiences have helped to add validity and diverse examples in the development of the ARCS model (Keller, 2010b). The following research reflects examples of the implementation of the ARCS model focused on BMS and STEM education and career exploration.

The continuation of Hispanic students' learning in BMS via a high school career pathway or career academy embodies the continuous learning that career exploration programs unfold over time. In previous research, the ARCS model has been used as a lens in STEM education illustrating how it might be applied to the study of student motivation and achievement (Feng & Tuan, 2005). STEM career exploration has been studied in several ways at the high school and postsecondary level, but information is lacking about the student motivation in this area in middle school (Brown et al., 2020; Grant et al., 2021). Career exploration has typically been studied as an innovative pedagogy or as a program such as a career pathway or a career academy in high school or at the postsecondary level (Chine & Larwin, 2022). Examining motivation in high school

as it relates to middle school career exploration was important to this study because this area is not prevalent in middle school and thus may be a factor in showing that the students' learning motivation is a significant correlation with their learning performance (Zhang, 2025). The ARCS model was the best choice when focusing on Hispanic students' career interests and their learning motivation in high school and how it can translate into middle school career exploration programming. The ARCS model enhances student learning through stimulation and motivation by focusing on relevance to keep their attention, while building their confidence and satisfaction (X. Li et al., 2021).

The ARCS model can be applied to instructional design by incorporating attention-grabbing techniques, such as multimedia or real-world examples, to capture learners' interest (K. Li & Keller, 2018). It can also enhance relevance by relating the content to learners' personal experiences or future goals (Kahraman, 2022). Additionally, the ARCS model suggests strategies to increase learner confidence and satisfaction, such as providing frequent feedback and opportunities for success (Kahraman, 2022). Traditional education models no longer meet the needs of students in the modern classroom, therefore new education methods and models are emerging to the forefront that students find more relevant and keep them motivated to want to learn (Zhang, 2025). Teachers are realizing that diversifying their teaching methods and strategies are necessary when preparing their lessons to effectively stimulate students' interests and learning motivation (Ge et al., 2021). Students' communication skills, learning attitude, and motivation were not significantly impacted by traditional project-based learning (Wijnia et al., 2024).

The results of a study using the ARCS model demonstrated that junior high school students' performance in the three dimensions of effective expression, listening comprehension and empathy significantly improved using gamified STEAM project-based learning and targeted communication skills guidance (Wijnia et al., 2024). It is important to note that diverse skill levels within a classroom need further research, however, there is a lack of research on how to capture and sustain student interest, thereby providing relevant learning opportunities (Zimmer & Matthews, 2022).

As part of the ARCS model, instructors should focus on capturing and keeping student attention, making content relevant, improving students' confidence, and leaving them with a satisfying academic experience. Using the ARCS model, Atin et al. (2022) conducted a study using gamification in a classroom setting involving a math computer program that incorporated a gamified system into class lessons. By awarding points and badges for completing assignments and reaching milestones, it was discovered that there was a significant increase in student engagement and motivation to learn, resulting in improved learning outcomes. It was found that there was a 42% increase in student understanding, student interest in applications increased by 35%, and there was a 33% increase in student motivation (Atin et al., 2022).

Making content relevant to students' lives is crucial because it helps them see the practicality and relevance of what they are learning and increases their motivation to engage with the material. Teaching materials do play a critical role in teaching practices today (Xueli et al., 2024). When students can connect the concepts and skills they are acquiring to their own experiences and interests, they are more likely to actively

participate in the learning process and retain the knowledge in the long term. A meta-analysis study by Materials that are designed using the ARCS model do affect student attention and motivation and as attention increased, student motivation was also maximized (Xueli et al., 2024). Furthermore, the ARCS model shows that attention should be placed on many teaching models and special consideration to student attention when designing teaching materials (Xueli et al., 2024).

Relevance of the ARCS Model

The ARCS model was relevant for this study as it offered a lens from the perspectives of BMS teachers who currently work with Hispanic students in their classroom. These perspectives focus on how they see their students' attending to content, expressing confidence in their learning, seeing the relevance of the content leading them to continue their focus on BMS careers. It is important for students to experience their achievements so they can develop self-esteem, get the chance to interact with other people, hear and respect their points of view, and overcome challenges that will improve their confidence (Keller, 2010a). The ARCS model can also be used to design and improve instructional motivation in STEM-healthcare career exploration with middle school Hispanic students.

Literature Review Related to Key Variables and/or Concepts

There is a gap in the literature regarding the lack of diversity in BMS. The review of the literature begins with a comparison of the diversification of Hispanic healthcare providers to their counterparts. The literature reviewed in this section provides the rationale for the implementation of BMS career exploration coursework in middle school.

Hispanic Representation in BMS

It is imperative that the BMS diversifies its Hispanic student population to reduce barriers to healthcare access, promote inequities in health research, and grow innovative leaders. (Bhatt et al., 2020). Although there is a greater support from family and community supporting Hispanic students and their career development process, there continues to be differences between students' personal career goals and the cultural and parent expectations that present challenges for Hispanic students in the United States (Hansen et al., 2023). There remains a concern within the healthcare industry, as specific ethnic groups remain underrepresented in health care. As of 2022 5.4% of healthcare workers identified as Hispanic, Latino, or Spanish (Tello & Goode, 2023). Since the COVID 19 pandemic, medical schools have seen an 18% increase in medical school applicants (American Association of Medical Colleges [AAMC], 2022). Furthermore, the new data shows that medical schools in the U.S. continue to recruit diverse classes that include Hispanic, Latino, or of Spanish origin increasing by 4% with these same individuals from this group making up 12% of total matriculants (AAMC, 2022).

Hispanic students from kindergarten through 12th grade (K–12) are more likely to pursue and succeed in future healthcare careers when specific factors are in place. These factors include parents that are involved and supportive, education offered in a bilingual setting , teaching that is culturally relevant, early exposure to STEM careers, expressed interest in STEM subjects, and self-confidence in STEM learning environments (Hansen et al., 2023). Achieving these goals is essential to make certain that Hispanics have equal access to STEM career opportunities and are financially leveraged (Jong et al., 2020).

Ulloa et al. (2018) interviewed 23 Latino and African American surgeons using an in-depth, semistructured approach that focused on the structural and perceptual barriers that they faced in becoming a surgeon. The results from the participants' interviews identified three themes, including the minority experience focusing on how elementary and secondary education play a role in offering students career exploration opportunities early. Additionally, over the past 5 years, early exposure programs have created a pipeline for underrepresented minorities through exposure to the medical field, mentorship, and networking (Clayborne et al., 2021).

The financial cost to become a health professional has impacted Hispanic students, although they may have displayed an interest in entering the profession. The financial challenges that Hispanic students have faced are even more pronounced compared to other ethnic groups as they are more likely to have lower socioeconomic status (Ghazzawi et al., 2021). While striving to achieve academic and career success, Hispanic students may also have to cope with socioemotional, economic, and familial stressors (Olivarez et al., 2022). For many Hispanic students, it is difficult to express their career goals to their families due to limited exposure and knowledge (Bhatt et al., 2020). Educators also must focus on what motivates Hispanic students to want to pursue STEM careers. Those students who completed a career relevant course related to STEM areas more likely continued to earn a STEM degree (Burt et al., 2023).

Considerable evidence has been published that shows the increased number of healthcare providers from diverse backgrounds. Recognizing the underrepresented groups as well as those who come from rural communities and low socioeconomic status, was a

vital step in tackling both the projected primary-care physician shortage and healthcare disparities (Tello & Goode, 2023). Those who identified as disadvantaged or underprivileged expressed that although they wanted to become a medical or healthcare professional, they did not feel they had the resources or the support to reach their goal (Ulloa et al., 2018). Additionally, Havemann et al. (2023) interviewed medical students who indicated that they struggled in several key areas that made medical school particularly challenging. They lacked resources compared to their peers, did not receive adequate support from their institutions or faculty members, felt othered within medical school, and had to be resourceful and resilient as they faced various challenges. Furthermore, despite the research showing that feedback given from teachers directed towards empowering minority students, there has not been enough done within the curriculum to include more relevance and real-world application for them (Gray et al., 2020).

BMS Career Exploration in K–12

No longer is college and career readiness entwined in name only with more states and communities prioritizing career pathways starting in high school with students completing a postsecondary credential, and students exploring their career interests earlier (Conrad et al., 2023). It is imperative that college and career preparation is included in classrooms to help reduce the disparities that Hispanic students face. This includes providing transportable job skills that are connected to career certifications and college degrees (Bonilla, 2020). It is also important to remember that many underrepresented students are active participants within their families. Providing them

with the flexibility of a nontraditional school day as well as paid internships to support their learning helps with meeting their educational goals (Havemann et al., 2023). Higher education and K–12 education policy leaders are responding to this economic reality by setting more ambitious goals for postsecondary credential attainment and making college and career readiness a larger focus of their secondary school strategies (Fletcher & Tan, 2022). This study analyzed the perspectives of teachers and the influence that high school BMS career exploration, such as PLTWBMS coursework, on the motivation of Hispanic students to continue BMS careers and how it can translate into middle school career exploration to grab the attention of Hispanic students at an earlier age and grow the pipeline of Hispanic healthcare providers.

Career Exploration for Hispanic Students

In a competitive economy, it is vital that our underrepresented students obtain the education and training necessary to elevate themselves to a level of identifiable success (Garcia & Center for Law and Social Policy [CLASP], 2019). States and communities have begun to recognize that industry-recognized credentials are a critical component to student learning and a responsiveness to the new economy (Braxton, 2023). It is necessary to retain Hispanic students in BMS related careers to spark creativity and empower new ideas focusing on medical-related treatments and research (Clayborne et al., 2021). Although there were some improvements made by minority students in the United States in the early 2000s, there is still 15 to 20 percent of minority students who do not complete high school (Wells et al., 2023). Additionally, although minority

students express a desire to pursue a future in science, they are not receiving the support necessary to be successful (Barongan et al., 2023).

The research shows that middle school students begin to develop positive attitudes toward STEM-related careers that require a college degree (Thursby Bourke et al., 2024; Tsai et al., 2023). Continuing to ignore the recruitment of underrepresented students in STEM careers will exclude those who can contribute to the workforce (Hangen et al., 2025). Improving students' postsecondary success means engaging them in education curriculum with an emphasis on STEM-related disciplines (Burt et al., 2023). STEM careers offer students the opportunities to access high demand and high-skilled jobs where they are earning competitive wages (Plasman et al., 2024). Career pathways offer Hispanic students real-world applications that can help improve their learning and performance while exposing them to postsecondary education and career options (Ecton & Dougherty, 2022). Middle school students, specifically Hispanics, indicated that the support of their families was a driver of academic success and how they envisioned their futures (Albritton et al., 2020). Additionally, students desire to pursue a college degree was because of the encouragement and support of their families as well as their teachers (Carey, 2021).

The racial and ethnic disparities in secondary career exploration programs suggests that minority students, compared to their peers, are less likely to have access to career pathways or programs that focus on STEM (Fletcher, 2022). Research suggests that there are gaps in the workforce demonstrating a lack of qualified Hispanic individuals obtaining an associate degree or higher. Systemic barriers account for the

relatively low number of Hispanics ages 25 or older who have earned a high school diploma in comparison to almost 62% of their white peers (Storlie & Toomey, 2020). For young people from across the social and economic spectrum, career pathways can be an important road to the middle class, but racial and ethnic disparities in these career readiness courses may exacerbate later inequities in the workforce rather than ease them (Fletcher, 2022).

Career readiness coursework that is engaging and challenging is necessary for academic growth in STEM areas (Plasman et al., 2024). Authentic well designed STEM programs that take place outside of the traditional school setting have also been shown to influence Hispanic students to express interest in these careers (Barongan et al., 2023). This engagement is critical because STEM fields need career-minded individuals to remain competitive on an international level (Plasman et al., 2024).

Career Exploration in Middle School

It was essential to understand what career pathways and career exploration offer students at the secondary level, both middle and high school, and look at the history of these models and how they have evolved in education. According to Hemelt et al. (2019), career pathways are multi-course, scaffolded education programs that combine transportable and industry skills using application-based instruction, work-based learning, and additional career-focused curriculum. High school students are faced with choices regarding their next steps after graduation. The confidence gained while in school significantly influences their career choices moving forward (Rosenzweig & Chen, 2023). Those minority students who participate in pipeline programs, such as BMS, are

successful because of the confidence they gained due to the program (Yelorda et al., 2021).Although career pathways are a successful alternative to the traditional high school education, it is imperative to remember that seventh to ninth grade is the most influential time to introduce STEM careers to build interest and student confidence regarding mathematics and science (Tello & Goode, 2023).

Traditionally, career exploration, as career pathways and CTE, has been a focus in high school and postsecondary. However, the conversation is now focusing on how more career exploration, including teaching transportable skills, should get underway in middle school. (Tsai et al., 2023). For Hispanic students, STEM education is of crucial importance from an early age (Jong et al., 2020). As an example, a pilot study on Genetic Counseling in a middle school science club was created to gauge the feasibility of presenting genetic counseling as a viable career option to middle school minority students with the goal of increasing their awareness of and interest in genetic counseling (Minen et al., 2023).

Students who were exposed to STEM as early as the eighth grade were also more likely to earn a STEM degree and enter a STEM career. (Jong et al., 2020). Playton et al. (2023) stated that it is during the middle school ages that students' STEM self-confidence as well as their beliefs and interests begin to solidify. The pilot study by Minen et al. (2023) with middle school minority students generated findings reinforcing Playton et al., with promising implications for how the genetic counseling profession might continue to work toward greater diversity.

Studies have shown that middle-school students tend to lose interest in STEM careers (Brown et al., 2020). When there is a lack of student interest in STEM after 8th grade, it often deters and hinders entry into postsecondary STEM majors and careers. (Ihrig et al., 2022). Most students who are STEM college graduates reported having an interest in math and science while in elementary or middle school (Pike & Robbins, 2019; Thomas & Larwin, 2023). The attitudes in early middle school Hispanic students must be addressed through avenues like career awareness and preparation programs focused on students' interests, general education, and career pathways to make a permanent and lasting impact on the quality of the STEM workforce (Mulvey et al., 2022).

It is well documented that Hispanics are underrepresented in STEM fields, and proficient students say they do not intend to pursue STEM degrees and careers in large numbers (Pike & Robbins, 2019; Ro et al., 2024). Students tend to acquire more advanced skills related to industry standards as they transition into adolescence, increasing their chances of success as they get older (Albritton et al., 2020; Mulvey et al., 2022). Students can be persuaded to pursue careers in science and mathematics in seventh through ninth grade through building self-confidence and positive attitudes (Thomas & Larwin, 2023). Students who develop STEM interests no later than 8th grade are more likely to declare a STEM degree as opposed to their counterparts who are not exposed to STEM career exploration and development while in middle school (Mulvey et al., 2022). Furthermore, Hispanic eighth graders saying they would like to enter a science profession in the future are much more likely to follow through on their plans because they were

exposed to STEM career exploration and development while in middle school (Park-Taylor et al., 2022). To address the demand for more Hispanic BMS and healthcare professionals, the implementation of middle school career exploration coursework and programs is necessary. Despite the growing number of secondary BMS and health programs, little research exists on the effects of participating in these programs on Hispanic students who pursue BMS degrees and careers after high school.

BMS Career Programs for Hispanic Middle School Students

States and communities need a more competent and qualified workforce to help employers grow and sustain a competitive edge in an everchanging economy (Hedge & Carter, 2020). As minority populations in the United States continue to grow, it is imperative that we develop and maintain a diverse workforce skilled in STEM, specifically science, engineering, and mathematics to stay competitive globally (DeCoito, 2024). Research has consistently shown that opportunities in authentic STEM settings are the most influential for underrepresented Hispanic students.

Improving the diversity of the healthcare career pipeline can begin as early as the elementary school level (Minen et al., 2023). Students often turn away from STEM subjects before they enter 8th grade due to a lack of interest, frustration, or difficulty. (Jong et al., 2020). Positive experiences in science are usually identified in students by the age of ten, with that interest sharply declines by the middle school years, typically ages 12–14 years (Ihrig et al., 2022). It is imperative that students interested in STEM fields also be proficient if they want to earn a degree in these areas. Nearly all graduate students who are actively working in STEM fields report developing a passion for STEM

before or during middle school (Pike & Robbins, 2019; Ro et al., 2024). In addition, another study showed that 24,000 students were surveyed, indicated that they change their career goals constantly between 9th and 11th grades. This can include a changing relationship between STEM intention and motivation (Kim & Beier, 2020). With the BMS-healthcare occupation interests of Hispanic students changing when in high school, beginning career exploration in middle school is necessary where their learning interests are actively developing.

The increasing demand for STEM-skilled professionals is a global trend, so diversifying the STEM education to career pathway will benefit the global STEM market (Coleman, 2020). Researchers have noticed that underrepresented students must overcome more obstacles to attain post-secondary degrees and advancement in STEM careers (Albritton et al., 2020; X. Li et al., 2021). Students demonstrate an interest in BMS and healthcare when they demonstrate the ability to think critically and solve problems. However, it is realistic to say that a unequal number of underrepresented students, particularly Hispanics, are even further away from becoming STEM-literate and having the ability to thrive in a hyper-competitive, global marketplace (Coleman, 2020). Education systems today see many disparities that impede student learning. This includes those students affected by socioeconomic status, language, and cultural barriers, which directly affect Hispanic career exploration and aspirations (Storlie & Toomey, 2020). Considering the increased number of Hispanics in the United States, a crucial aspect of increasing Hispanic students' motivation in STEM fields is implementing interventions in the early years of school (Fàbregues et al., 2023). Middle school is where students can

develop their interests in BMS and healthcare fields and career exploration interventions can motivate Hispanic students.

It is beneficial for Hispanic students to take more advanced mathematics and science courses in high school, so they are better prepared to pursue advanced BMS coursework at the post-secondary level. (Jong et al., 2020). Furthermore, misconceptions that are formed by Hispanic students about careers and perceived career obstacles lead them to engage in career-oriented behaviors that ultimately define their future goals (Fàbregues et al., 2023; Thursby Bourke et al., 2024). There is an identity crisis in STEM fields, specifically those who are considered underrepresented or minorities, including women (Gottlieb, 2018; Park-Taylor et al., 2022). Real-world learning has helped Hispanic students connect to STEM careers (Gray et al., 2020). Chavez et al. (2019) interviewed and observed 79 students in 11^{th,} and 12th-grades enrolled in a biomedical research program. The results indicated a positive post program trend and revealed evidence that students are continuing with STEM-related education and careers. Data from a study by Karara et al. (2023) shows that students enrolled in a biomedical research training program have a substantial growth in STEM career interest, specifically as a biomedical scientist and also reported significantly higher levels of agreement with the statement “I know I would like to pursue a STEM career”. Students' attitudes, personal beliefs, and their ability to see themselves in these careers need to be shaped by hands-on application and learning opportunities, adult mentors including community partners, and relevant experiences. If we want to improve Hispanic students’ confidence and STEM identities, there must be an increase in relevant application and mentorship or internship

opportunities for these students (Chavez et al., 2019; Ihrig et al., 2022). Furthermore, if Hispanic students want to reach their career goals, they must have opportunities offered to them focusing on real-world BMS settings (Jong et al., 2020). Therefore, authentic STEM teaching and learning should take place no later than 8th grade if we want to keep them engaged and excited about BMS careers (Park-Taylor et al., 2022).

For students to have a constant desire to continue learning, they must continue to be satisfied with the outcome of their learning experience (Kahraman, 2022). This includes the need for authentic settings that offer students that desire to continue learning as mentioned in research by Karara et al. (2023) and Wiebe et al. (2018). This research looked at the connection between core academics, such as math and science and the career pathways ensuring that 21st century job skills are focused specifically on student learning in K–12 STEM education. Many career pathways programs also supplement academics with proactive student support such as academic advising, career guidance, and case management (Hedge & Carter, 2020). Additional authentic opportunities for Hispanic students improved student academic behavior and other necessary career-related skills. If we want Hispanic students to take STEM coursework while in high school and eventually pursue STEM careers, career exploration programs are necessary to set the foundation for learning that will excite them to continue moving forward (Chavez et al., 2019; DeCoito, 2024). Furthermore, for Hispanic students to demonstrate a genuine interest in science, we need to strengthen their scientific knowledge, their communication skills, and their appreciation for science as well as developing their competence and ability in science (Hansen et al., 2023).

The notion that authentic STEM-healthcare experiences play a meaningful role in Hispanic students was supported by Xia et al. (2024). Informal programs enable Hispanic students the opportunity to participate in authentic, real-world scenarios that reinforces critical thinking, something they cannot find in school textbooks (Minen et al., 2023; Xia et al., 2024). Opportunities provided for student engagement in the BMS-healthcare career pipeline not only increases the number of Hispanic students entering BMS careers but also increases the diversity in these career areas (Park-Taylor et al., 2022).

Any career pathways component or system, regardless of whether it is designed for use in educational or organizational contexts, should be purpose driven (Hedge & Carter, 2020). Healthcare career pipeline programming is one potential solution; however, despite the efforts of existing pipeline programs, minority students remain underrepresented in healthcare professions (Minen et al., 2023). These out-of-school experiences develop student BMS and healthcare competencies as it provides students with the freedom to explore and position themselves in these disciplines and choices of careers (Ihrig et al., 2022; Xia et al., 2024). Therefore, middle school Hispanic students require strategic and planned supports intended for these students as part of their coursework as they explore these potential careers (Albritton et al., 2020; Park-Taylor et al., 2022; Ritten, 2025).

Out-of-School Time Opportunities

Afterschool programs, also called “out-of-school time programs,” focusing specifically on science, is known to be notably productive in helping Hispanic students and are rooted in principle focused on positive attitudes and STEM identity (Lincoln et

al., 2023). Afterschool programs also focus specifically on abstract thinking and social-emotional learning that also helps to develop proficiency and excitement in STEM, thus improving the chances that students will want to continue in a STEM career in the future (McDavid et al., 2020). Giving Hispanic students BMS opportunities using real-world, application-based learning scenarios is vital for their future success (Jong et al., 2020). Out-of-school learning environments offer students STEM experiences using career relevance that also establishes an outlet for them to overcome obstacles that they may otherwise face when exploring STEM identities (Kier & Blanchard, 2020).

Afterschool programs can also be a positive outlet for building relationships, improving life skills, enhancing critical thinking, and developing social emotional learning (McDavid et al., 2020). To alleviate the gap in BMS healthcare careers for Hispanic students, it is critical that more enrichment is incorporated into afterschool programs (Drazan, 2020; Hangen et al., 2025). One such program, Gains in the Education of Mathematics and Science (GEMS) summer program, was created in 1995 to target enrichment and supplemental classroom learning to keep middle and high school students interested and excited about STEM (Brown et al., 2020).

Non-traditional learning environments are also a perfect space for students to be innovative because there are no limitations that must be placed on them. This allows them to build excitement and self-confidence in STEM areas (Drazan, 2020; Hangen et al., 2025). Afterschool programs providing authentic learning experiences as well as valuable mentoring opportunities to underrepresented youth changed their attitudes towards science and increased their science achievement (Kier & Blanchard, 2020). Out-

of-school opportunities give Hispanic students the opportunity to build relationships with other peers and adults giving them those STEM networks and role models that they can identify with (Drazan, 2020; Hangen et al., 2025). These programs also present Hispanic students with positive connections that they may not otherwise have in their learning, specifically in STEM (Hsu et al., 2020). Evaluations conducted on the GEMS program overwhelmingly highlighted students' responses revealing that they highly valued their mentors, enjoyed challenging hands-on activities to learn science, had gained more positive attitudes about science, and learned many science concepts and specific laboratory skills in the GEMS program that were not taught in their school curriculum (Brown et al., 2020).

Programs such as the biomedical research program that Chavez et al. (2019) and Karara et al. (2023) observed, offered opportunities in BMS and healthcare career exploration that secondary Hispanic students would not otherwise receive. According to Fernandez-Repollet et al. (2018), there are increased efforts to engage Hispanic students in healthcare and get them excited about these careers because they are more likely to remain in their communities to service those very people that they follow. Secondary students that participated in out-of-school education programs and who met with scientists and mentors through field trip participation to universities increased their awareness of STEM careers and could picture themselves as scientists (Hsu et al., 2020). Data has shown that there is a surging curiosity for STEM that has led to improved self-confidence in students (Forakis & March, 2022; Xia et al., 2024). One example of an out-of-school time program, Health Sciences and Technology Academy (HSTA), services

minority high school students who have demonstrated success in STEM-based college degree programs with 87% of HTSA students earning an undergraduate degree and an additional 27% earning graduate degrees (McKendall et al., 2025). According to McKendall et al. (2025), HTSA focuses on first generation college youth to improve STEM education, offer leadership opportunities in the community, and increase opportunities to enter healthcare careers in their communities.

Yelorda et al. (2021) noted that despite the benefits of exposure to healthcare career exploration, many high school students were disheartened by the lack of representation of minorities enrolled in medical schools. Throughout the study, there is substantial evidence that camaraderie or connectedness with the "community of practice" is critical for professional development. Research by Fernandez-Repollet et al. (2018) showed that Puerto Rican middle and high school students scored significantly higher after completing the post internship and distance mentoring Health Science Knowledge and Interest Inventory. Furthermore, the scores of these middle school students were considerably higher after mentoring (Fernandez-Repollet et al., 2018). This study indicated that out-of-school-time programs specifically for middle school students are a critical component in the career exploration and self-identification of these careers. It is apparent that informal STEM experiences are connected to students' anticipated engagement in STEM careers, nevertheless increasing informal STEM programs may not be enough to increase participation (Drazan, 2020; Hangen et al., 2025). Additionally, a study by Carey (2021), discusses that minority students who achieve success do so through self-diligence, focusing on family and community, personal development, and

showcasing using examples as they develop their proficiencies to succeed. Where informal out-of-school programs may still miss the mark on improving the STEM pipeline, these programs do influence students to look at STEM-healthcare careers more seriously.

Project Lead the Way

PLTW, a nonprofit STEM organization, offers a teaching and learning experience focused on STEM foundations with several pathways ranging from Launch (for Elementary) to secondary learning (Nomi et al., 2024; Stebbins & Goris, 2019). PLTW is a formal, in-school STEM curriculum that provides three different courses of sequence engineering, BMS, and computer science—for prekindergarten through 12th grade (Project Lead the Way, 2026). Along with an engineering and computer science curriculum, PLTW introduces BMS beginning as early as prekindergarten and introducing industry skills as early as 5th grade continuing through high school. Additionally, PLTW offers STEM elective courses in middle school and high school classes in engineering, computer science, and BMS offered as individual STEM electives that comprise career pathways offering an introductory class with additional courses that scaffold from the initial course (Pike & Robbins, 2019; Project Lead the Way, 2026). While the PLTW foundation classes are developed to help students build a strong foundational knowledge and create excitement for the individual STEM fields, a selection of more advanced and customized courses is designed for students (Nyaema et al., 2021; Pike & Robbins, 2019). PLTW Gateway, the middle school program, introduces middle school students to STEM careers (Thomason & Hsu, 2024). The completion of the

PLTW Medical Detectives course may pave the way for students to continue with four additional sequential classes in the PLTW BMS while attending high school.

Hispanic representation in the U.S. is increasing, so it is imperative that STEM frameworks and learning begin early to boost young Hispanic students' motivation in STEM fields (Fàbregues et al., 2023). An evaluation of PLTW indicates that it is effective at overcoming the interest and proficiency deficits that hinder high school students from pursuing a STEM-healthcare related degree (Pike & Robbins, 2019; Thomason & Hsu, 2024). The implementation of PLTW Gateway PLTW Medical Detectives in middle school for Hispanic students can be relevant because the research points to these years as a critical time in determining later career aspirations and adolescents forming their STEM identities before starting middle school (Thomas & Larwin, 2023).

From an instructional standpoint, PLTW courses are based on the STEM philosophy of project-based and inquiry learning compared to traditional schools without STEM programs that typically teach STEM content in a conventional, stand-alone format (Brown et al., 2020). Providing students with real-world experiences, that leads to discussions about those experiences and making choices, helped them become career-ready (Seevaratnam et al., 2023). Furthermore, academic engagement has been positively related to students' higher educational pursuits, positive self-esteem, higher academic achievement, and positive classroom behaviors (Thomason & Hsu, 2024).

Summary and Conclusions

This chapter included a review of research related to the study's conceptual framework, Hispanic representation in BMS, BMS career exploration in K–12 and BMS career programs for Hispanic middle school students. Student motivation using Keller's (1979) ARCS model of motivational design provides the framework for the study. Researchers recommend that all elementary and middle schools include career exploration in their educational programs (Wang et al., 2023). The precollege preparation in BMS of Hispanic students is important in determining their tenacity at the post-secondary level, particularly by completing more advanced mathematics and science courses (Jong et al., 2020; Quiroga Velasquez, 2025).

It is currently unknown how middle school STEM career exploration programs can motivate Hispanic high school students to continue pursuing BMS career interests. Young Hispanics make career choices based on misconceptions and perceptions of the future, so identity plays a vital role in guiding future career choices (Thursby Bourke et al., 2024). An introduction to STEM, including BMS, is presented through PLTW introductory courses, followed by specialized courses for secondary students (Thomas & Larwin, 2023). Middle school students completing the PLTW Medical Detectives course may pave the way for Hispanic students to continue with four additional sequential classes in the PLTW BMS while attending high school.

In Chapter 3, I describe the research design and rationale as well as the role of the researcher. I also offer an overview of the participation selection logic and the instrument I used in the study. I offer a review of my recruitment procedures, study participation,

and data collection. Lastly, I discuss the plan for data analysis I used in the study and the issues of trustworthiness during the study.

Chapter 3: Research Method

The purpose of this basic qualitative study was to explore high school teachers' perspectives of how middle school STEM career exploration programs can motivate Hispanic students' interest in BMS careers. To fulfill the purpose of this study, I explored the perspectives of high school BMS teachers who currently teach Hispanic students and previously completed a middle school STEM career exploration program to pursue BMS career options. In Chapter 3, I describe my research design and the rationale. I also discuss my role as a researcher. The Methodology section includes details of the participant selection, instrumentation, recruitment, and data collection and analysis. The chapter concludes with a discussion of trustworthiness and ethical considerations in this study.

Research Design and Rationale

I developed the following research question based on the conceptual framework and the literature review: What are high school teachers' perspectives on how middle school STEM career exploration programs can motivate Hispanic students' interest in BMS careers? The central phenomenon studied came from the perspectives of high school BMS teachers of how middle school STEM career exploration programs can motivate Hispanic students' interest in BMS careers. Their experiences were based on their high school BMS career exploration courses and how they motivate their Hispanic students The selection of a basic qualitative research approach was appropriate for this research study because it seeks to understand high school PLTW BMS teachers perspectives on their Hispanic students' experiences that the other qualitative approaches

would not be able to produce. This basic qualitative design, also referred to as a basic qualitative inquiry, uses open-ended questions as part of the study and asks the participants to focus on real-world settings as a lens to help solve possible problems presented that may include program improvement and policy development (Patton, 2015; Ravitch & Carl, 2016).

The rationale behind the research approach was based on the purpose of the study and identifying solutions to the research question. The present research focuses on the motivational aspects of the high school PLTW BMS courses based on the individual interviews of current high school PLTW BMS teachers servicing Hispanic students. Data was based on description, experiences, and perspectives from the teacher participants. It is essential to rely on firsthand knowledge (Rubin & Rubin, 2012). The methods of qualitative inquiry stand on its own as a reasonable way to find out what is happening in these programs that influence students' choices (Patton, 2015).

A basic qualitative study was selected in alignment to the personal PLTW BMS teacher perspectives of their Hispanic students' experiences in the PLTW BMS courses. Because this research study focused on the perspectives from PLTW teacher participants' interview responses, this methodology was an appropriate approach for capturing the teachers' perspectives regarding their high school Hispanic students' experiences in the PLTW BMS coursework and how their experiences can influence middle school BMS career exploration programs to motivate middle school Hispanic students' interests.

Other Qualitative Approaches Considered

This study examined high school PTLW BMS teachers' perspectives of the who currently work with Hispanic students in their classrooms. These students also completed one or more of the PLTW BMS courses while attending high school. Additional qualitative approaches were considered for this study, including case study research, ethnography, narrative inquiry, and evaluation research. Ravitch and Carl (2016) define case study research as a "method involving studying a case of contemporary, real-life events" (p. 20). The case study research method was not appropriate because it did not seek to understand PLTW BMS curriculum as a product. Instead, it related to how the courses encourage the interests of Hispanic high school PLTW BMS students and how the courses helped them see themselves in a BMS-healthcare career. Using detailed, comprehensive data collection, a case study explores a closed system over time using multiple sources of content-rich data (Patton, 2015). Documents, artifacts, interviews, documents, and direct observations can all be considered as sources of information (Ravitch & Carl, 2016). This qualitative study focused only on high school BMS teachers' perspectives and descriptions of their Hispanic students' experiences who have completed one or more of the high school courses and how it encouraged their interests in pursuing a career in healthcare or BMS.

In addition to the case study research design, ethnography was also considered for this study. Ravitch and Carl (2016) stated that ethnography provides an immersive insider perspective on a phenomenon using an inductive process (Ravitch & Carl, 2016). In this study, ethnography was not an appropriate choice in methodology because an inductive

process was not utilized in this study. Deductive processes were used starting with the a priori codes based on the ARCS conceptual framework as the focus. Ethnographic inquiry also takes as its central and guiding assumption that any group of participants interacting together for some time will drive organizational growth (Patton, 2015).

Evaluation research, also known as formative evaluation, was the last methodology approach considered for this study. The purpose of evaluation research is to improve intervention such as a program, policy, organization, or product (Patton, 2015). Ravitch and Carl (2016) further stated that evaluation research is used "to provide accountability, analysis, and learning, and for advocacy" (p. 22). Although this study investigates middle school career exploration programs as a phenomenon, the focus of this study was not about collecting information on the program through data sources. However, the focus of this study was capturing more broadly using the perspectives of high school PLTW BMS teachers who service Hispanic students who are currently enrolled in the high school BMS courses and how they felt broadening career exploration into the middle school realm would inspire Hispanic students to want to explore these BMS careers earlier. These teacher perspectives and descriptions were expressed through individual interviews containing open-ended questions, focusing on how their students' participation in the high school BMS career exploration coursework and how these courses influenced their interests in BMS-healthcare careers. Interviews also include how students' excitement is expressed in their learning as they continue with the BMS coursework and post-secondary options because they can self-identify with the career fields. These experiences can make way for the possibility of middle school career

exploration to inspire Hispanic students to want to start earlier and get them excited about BMS-healthcare careers.

Role of the Researcher

For this basic qualitative study, I served as the primary researcher. In my role as the primary researcher, the conceptual framework using the ARCS model guided me through the participants' interviews, data collection, and data analysis. By cultivating research questions from the conceptual framework, then matching methodological aspects to the questions, the study can be put into perspective (Ravitch & Carl, 2016). Prior to conducting interviews, I selected a research design, determined the participant criteria to be included in the study, determined the types of data sources, and created the instrument used for the data collection process. Additionally, I was responsible for the recruitment of the participants for the study, collecting, and analyzing the data, and ensuring trustworthiness using strategies known for qualitative research. There must be a robust research design in achieving validity and trustworthiness (Ravitch & Carl, 2016).

My role as a BMS teacher could have created a bias that could have been a problem within this study; therefore, my personal opinions or insights were not part of the study. As a researcher, to manage any bias within the study, the best source for finding participants fitting the sample criteria, including servicing Hispanic students, for inclusion was through the PLTW teacher online community forums and unofficial social media outlets. Such detachment is presumed to reduce bias (Patton, 2015). Avoiding bias was a critical part of the research. Mitigating bias in this study was crucial, so the

performance of member checks was vital (Ravitch & Carl, 2016). In addition to using member checks, I also performed reflective research journaling to mitigate possible bias.

Methodology

In this section, I provide details on the methodology of this research study. I cover the selection of participants, instrumentation, the interview process, participant recruitment procedures, interview participation, data collection, and procedures for data collection, areas of trustworthiness, including credibility, transferability, dependability, and confirmability, is discussed in this section.

Participant Selection Logic

The selection of participants focused on 12-18 high school PLTW BMS teachers. Purposeful sampling ensured the credibility and management of the participants. Purposeful sampling was strategically to focus on the case selection of PLTW BMS teachers who service Hispanic students that have completed one or more of the high schools BMS courses in as it aligns with the purpose, research question, problem, and data collection (Patton, 2015). Purposeful sampling can provide context-rich and detailed accounts of the study's research questions using a specific population that focuses on the teacher participants' PLTW role in the classroom (Ravitch & Carl, 2016). I looked for participants who taught one or more PLTW BMS courses for at least 1 year. I identified these participants from the unofficial PLTW BMS social media groups and personal learning communities.

Sampling involves selecting study participants to be questioned by a relatively larger population, which is the central focus of a research investigation or query (Islam &

Aldaihani, 2022). Saturation is widely used to assess the appropriateness of samples in qualitative research (Hennink & Kaiser, 2022). It is possible to detect saturation when several respondents repeat previous responses without adding anything new to the discussion (Saunders et al., 2018). To verify the trustworthiness of the study, it is essential that the literature is saturated and the data is cross-referenced. (Fusch et al., 2018). The study's focus was the ultimate driver of the study's design; therefore, a small sample size may reach saturation quicker than a study that aims to describe a process that spans areas of interest (Mason, 2010).

Instrumentation

For this basic qualitative study, I designed semistructured interview questions based on the research question, my literature review, and the four constructs found in my conceptual framework. Understanding the range of interview questions, the goals associated with each kind of question, and the differences among them are critical (Ravitch & Carl, 2016). Interview questions were created to align with the four constructs of Keller's (1979) ARCS model: attention, relevance, confidence, and satisfaction. The questions in the study were designed to be adaptable including probing questions to help clarify the central question and gather further evidence to deepen the data set (Patton, 2015; Rubin & Rubin, 2012). I followed an interview protocol when conducting the interviews. The interview questions reflect the four major constructs of the ARCS model and the possible emerging codes that lead to motivational influence, as described by Keller (1979; see Appendix).

Procedures for Recruitment, Participation, and Data Collection

A basic qualitative research design served as a guide to recruit teacher participants and collect data during individual interviews. The following section provides a detailed breakdown of how study participants were recruited for participation in this study.

Procedures for Recruitment and Participation

I identified participants for recruitment using unofficial online PLTW teacher learning communities and unofficial PLTW teacher social media platforms. I posted an invitation providing details of the study and participant selection criteria to these sites. Participants contacted me via email indicating interest in participating in the study and if it was determined that they met the selection criteria. In response, I sent a consent form to their email. They then indicated their consent by replying to the email with "I Consent". Once they consented to the study, we agreed on a date and time to meet via the Zoom virtual conferencing platform.

Due to the recruitment of participants from unofficial PLTW online teaching communities and unofficial PLTW teacher social media platforms, I did not need to obtain approval from the PLTW Director of School Engagement or PLTW. These platforms are started by PLTW teachers to support and share information and their PLTW teaching experiences and resources.

Procedures for Data Collection

Data collection consisted of interviews recorded on a laptop using the Zoom virtual conferencing platform. I was the only person collecting the data in this study. I

used a laptop computer with an external microphone to conduct interviews with PLTW BMS teachers. Interviews over the course of six to eight weeks and lasted between 30 and 45 min. The recording features in the Zoom video conferencing program were used to record the audio of the interviews for data collection purposes. Instructions were provided to the participants after they consented to the study so they could access the virtual conferencing platform and enter the interview. After the conclusion of the interviews, the interviews were transcribed using the Zoom transcription service and looked over again for authentication. Each participant was emailed a copy of the interview summary sharing my understanding of their interviews, and I also shared their responses from the interview so that they could confirm the accuracy. This served as member-checking. If participant numbers were not satisfactory, I followed up with a second round of recruitment processes using the same measures described earlier. This was to ensure that the study had the number of participants necessary to complete the data collection for the study.

Data Analysis Plan

The data analysis plan included the use of three levels of coding (Dalkin et al., 2020). The three levels of coding included open codes, a priori codes, and lastly identifying categories and themes. I started with open coding as a preliminary analysis to identify common codes within the transcripts. The open coding process involved the identification of essential concepts and patterns in the data by researchers (Bingham, 2023). A Microsoft Word document was used to assist with the open coding process. I transferred responses from the transcripts collected from the Zoom platform into a Word

document. First, I removed any identifying information from the transcripts including names of participants, student's names mentioned during the interviews, and schools or school districts that were identified in the interview transcriptions. During this round of coding, data and existing codes were explored in detail, and color coding was used to delineate similarities and differences.

The second level of coding involved a deductive analysis approach, using a priori codes. A priori codes were created prior to data analysis based on experience or from understanding the occurrence or event and applied to the collected data (Bingham, 2023; Saldaña, 2015). The a priori codes of attention, relevance, confidence, and satisfaction (Keller, 1987) are aligned to the research question and purpose and were the second level of coding for this study. Table 2 identifies the a priori codes that were the focus during the data analysis process. It was imperative that data for the a priori coding was thoroughly examined to make sure sufficient data existed (Blair, 2015). As part of my reflexive journaling, I also developed a coding guide to keep track of code progress and growth and to assist in establishing an audit log that proved the reliability of my work.

Table 2

A Priori Codes Emerging From the Literature

Construct	Synonym
Attention	Engage
	Interest
	Consider
	Respond
	Engage
Relevance	Significant
	Important
	Meaningful

Construct	Synonym
Confidence	Belief
	Trust
	Empower
Satisfaction	Enjoy
	Success
	Pride
	Achievement
	Motivate

Note: This display synthesizes synonym words for each of the ARCS constructs. *Merriam-Webster*. (n.d.). *Merriam-Webster.com*. Retrieved March 31, 2025, from https://www.merriam-webster.com/thesaurus

The third round of coding included identifying emerging categories and themes within the data. Code categorization reviews what is coded and creates categories enriching and organizing the data (Saldaña, 2015). Using Dedoose, I used color coding to clearly outline the commonalities between existing codes and identify possible emerging themes that may have appeared.

A part of the data analysis plan was to identify discrepancies, also known as discrepant data. Researchers are likely to encounter data discrepancies when using a priori codes (Merriam & Tisdell, 2016). In cases where there appeared to be discrepancy in the data, I will review the cause of the discrepancy and identify outliers and explain the differences within the research. If discrepant data was discovered, I documented the discrepancies and discussed their potential implications in my research. Identifying and reporting discrepancies strengthened the trustworthiness of the study.

Issues of Trustworthiness

It is imperative that qualitative research is credible, meaningful, honest, verified, and supported (Patton, 2015). Data integrity was a critical part of the study because of how the data was collected and analyzed. Specific expectations, as outlined in this study regarding data collection, remained the same. Absolute certainty is always in question when considering qualitative research. Validity is both a process and a goal regardless of the approach used (Ravitch & Carl, 2016). Credibility, transferability, dependability, and confirmability are dimensions of validity that must not be overlooked.

Credibility

In qualitative research, Ravitch and Carl (2016) defined credibility as "the researcher's ability to take into account all of the complexities that present themselves in a study and to deal with patterns that are not easily explained" (p. 188). Also, for qualitative research to be credible, researchers should implement three strategies: member checks, adequate engagement in data collection, and discrepancy analysis (Merriam & Tisdell, 2016). If my research is to be credible, it is imperative to communicate with participants who are informed and knowledgeable about your concerns (Rubin & Rubin, 2012). For this study, I encouraged teacher participants to validate their responses from their interview through member checking. As a result of member checking, the participants were able to review a summary of their interview transcript to ensure their accuracy. Through the member checking process, research participants examined and confirmed their assertions (Patton, 2015). The member checking process adds an element of credibility to the study by allowing participants to

ensure that their perspectives have been accurately represented in the research findings (Saldaña, 2015). This strategy helped strengthen and improve the data analysis by integrating methods to study career exploration programs and their influence on Hispanic students (Patton, 2015). Using member checking helped confirm the data, and the inclusion of detailed descriptions of the data helped reaffirm the validity of the research findings.

For this study, teacher participants reviewed and verified that the member check from their interview reflect their perspectives of Hispanic students when participating in their high school BMS courses and how middle school career exploration programs could benefit Hispanic students earlier. I also used reflexive journaling, a written record, that I maintained during the research process. Reflexive journaling allowed me to maintain objectivity during the study. Member checking and reflexive journaling assisted me in eliminating the possibility of discrepant data that may have emerged. By using Keller's (1987) ARCS model throughout this study, I was able to perform a thorough review of the data. This analysis took place while looking at the data through a lens that allowed the examination of BMS programming and how it influences Hispanic students' interests and attitudes and their self-identification BMS-healthcare careers.

Transferability

In qualitative research, transferability refers to the ability to apply findings to broader contexts while maintaining contextual specificity (Ravitch & Carl, 2016). Providing detailed and rich descriptions of the teacher participant responses helped to support additional research in this area and determine if the findings in this study were

transferable in my research on how BMS and healthcare career exploration programs for middle school could influence the attitudes and interests of Hispanic students and how they self-identify in BMS careers. To ensure transferability, researchers need detailed descriptions along with the context of the data, so they can compare them against similar information (Blair, 2015). Because I used purposeful sampling, I was able to provide information in the form of descriptive details on the teacher participants necessary for the researchers reading my study.

Dependability

According to Ravitch and Carl (2016), dependability refers to the establishment or strength of the data. Dependability means that you have a compelling case for how the data is collected, and there is a consensus among the study's participants about the data (Saldaña, 2015). In this study, I justified why I selected a basic qualitative study as my inquiry design. It aligns my research with how the implementation of middle school BMS and healthcare career exploration could encourage Hispanic students to want to pursue careers in BMS and health care. I also explain how PLTW BMS teacher participants were selected using specific eligibility criteria, collecting data during the interview process, and interpreting data at the different levels of the coding process derived from the ARCS model conceptual framework.

I was also intentional about data collection and presenting my findings that aligned with the teacher interview narratives (Merriam & Tisdell, 2016). Additionally, according to Merriam and Tisdell (2016), the study's dependability is supported by the alignment between the data collection and the findings. Although there may be very

similar studies conducted or in the process, absolute replication nor the goal of a qualitative study is neither possible. I made certain that I followed my methodology with teacher participants to strengthen the reliability and the consistency of the study. Furthermore, to ensure replication and confirmation of the results, I kept detailed and meticulous notes regarding each step of obtaining, understanding, and explaining the data.

Confirmability

Qualitative researchers do not claim to be objective, so confirmability is often viewed as the qualitative equivalent to quantitative objectivity (Saldaña, 2015). The goal of confirmability is to consider and examine how our perceptions and assumptions map our data interpretations and mediate them as far as possible through processes of systemic reflexivity and external audits (Ravitch & Carl, 2016). Saldaña (2015) described creating and establishing a priori codes from experience and understanding a phenomenon before collecting data. Using a priori codes helped me to keep the predetermined codes aligned with the conceptual framework. The first, second- and third-cycle coding assisted me in identifying descriptive concepts and patterns. The use of open coding was necessary to analyze the initial data set. Reflexivity encompasses reflection throughout my study using journaling. This helped me take the reflective process deeper and make the research process more systematic (Patton, 2015). Reflexive journaling allowed me to keep a written record during my research explaining what I was doing and the reasons why. Keeping a reflexive journal of my thoughts and synopsis of the data analysis enhanced trustworthiness through the recording of a dynamic description of the data, emerging

codes and themes, and possible interpretations and conclusions (see Bingham, 2023). Reporting the research findings confirmed that the results with the teacher participants' interview responses, and the collection of data using the a priori coding in addition to, and second- and third-cycle coding ensured the confirmability of the study.

Ethical Procedures

The primary ethical consideration is the confidentiality of the teacher participants. A discussion and explanation of privacy and confidentiality occurred with the teacher participants before beginning the interview. Changing or not disclosing other identifying facts regarding the participants was a planned part of the data collection process. The continued practice of confidentiality moving forward remained a primary focus. The validity of the data is a critical part of the study because of how the data was collected and analyzed. Specific expectations remained the same, as outlined in this study regarding data collection. A qualitative research study's validity can never be fully assured; it is both a goal and a process (Blair, 2015).

For this study, following ethical procedures is critical, so applying to the Institutional Review Board (IRB) at Walden University was a vital part of the ethical considerations. First, I addressed the ethical concern of studying within my teacher curriculum content and programming. In the methodology section of my study, I was transparent about my role with PLTW and how my role as a PLTW Medical Detectives and BMS teacher was not connected to the potential teacher participants that were recruited for this study. Additionally, because I was a PLTW Medical Detectives and BMS teacher, my focus was on teacher participants from different schools outside of my

former school district that have students that serviced the student ethnic demographics that were the focus in the study. Along with transparency of my role, I obtained consent from the teacher participants for their participation in my research. The information disclosed to each participant included the study's purpose or objective, the eligibility criteria, the recruitment processes, and how I concealed the teacher participants' names. If the teacher participants' school district and school were mentioned during the interview, they were also concealed. Participants in the study were informed that their participation was voluntary, and they could withdraw from the study at any time. Participants who decided to withdraw from participating in the study before the study began were not stigmatized.

I addressed the ethical consideration of transparency by sending a friendly letter of invitation to potential study participants who met the inclusion criteria. Teacher invitations were only through the unofficial PLTW teacher community and unofficial social media page. Teachers participating in the study were informed that their participation was voluntary, as well as how they could opt out at any time. I briefed the potential teacher participants about how privacy and security of the data was kept for 5 years using a password-protected computer. Furthermore, the consent form outlined how data collection methods and procedures were used as part of the study, including member-checking as a vital component. Potential participants selected, who chose to volunteer to participate in the study, had already met the necessary criteria.

The ethical considerations regarding confidentiality were addressed in many ways. First, the interviews did not contain any identifying information. The recorded

interviews were transcribed through Zoom. Once the interviews were transcribed, they were removed from the online platform and transferred to two different locations, the hard drive of my computer with password protection and an external encrypted hard drive with password protection. I am the only person with access to this research data. I will continue to maintain access to this data for up to 5 years after completing this study. Upon completing this process, I will conceal the teacher participants' identities with a number and share no identifying traits or qualities throughout the research process or during the data analysis. After analysis and interpretation, data were stored and maintained according to Walden University's guidelines, and any hardcopy written materials were disposed of according to their requirements. These measures were taken to protect sensitive information and comply with privacy regulations.

Summary

The purpose of this study was to explore high school teachers' perspectives of how middle school STEM career exploration programs can motivate Hispanic students' interest in BMS careers. This chapter includes the research design and rationale, the role of the researcher, the methodology of the study, issues of trustworthiness and ethical considerations. The research design followed a basic qualitative study approach that was selected above other qualitative designs for its alignment. The selection of a purposeful sample was to strategically focus the case selection on teachers who service Hispanic students in alignment with the purpose, research question, problem, and data collection (Patton, 2015). In the role of the researcher, I share my role as the primary investigator of this study that determines the research design, the recruitment of teacher participants,

administering the questionnaire, and how the data analysis for the study was conducted. In the methodology section, I shared an outline of the selection of the participants for this study, including an interview guide for use during the semi structured interviews, and I shared the steps for the strengthened trustworthiness of the study. Chapter 4 describes the findings and results of this study. Teacher perspectives of how Hispanic student motivation in BMS career exploration programming are explored based on my research question. My final assessment and analysis of the data collection, the social implications for future practice, and my recommendations for further research are discussed in Chapter 5.

Chapter 4: Results

The purpose of this qualitative study was to explore high school teachers' perspectives of how middle school STEM career exploration programs can motivate Hispanic students' interest in BMS careers. Keller's ARCS motivation model was used as a framework for the study. The study focused on answering the following research question: What are high school teachers' perspectives of how middle school STEM career exploration programs motivate Hispanic students' interest in BMS careers? In this chapter, I will present the study results, and an analysis of the data collected via Zoom interviews with 13 PLTW Biomedical Science high school teachers. Details of the study's setting and demographic information will be provided, along with specifics of the data collection process and data analysis including codes, categories, and themes. Concluding this chapter, I will discuss the issues of trustworthiness and the study's results along with a final summary.

Setting

I recruited the participants for this study from unofficial PLTW BMS social media sites and participant referrals. The unofficial PLTW BMS social media site exists for PLTW BMS teachers who teach any four of the biomedical science courses and is focused primarily on teachers sharing classroom and teaching strategies and resources. Several interested teachers emailed me after noticing the post and tagged their colleagues that helped identify additional potential teachers. The participants did not mention any personal or working conditions that may have altered their experiences or the interpretation of the results of the data during this study.

Demographics

Thirteen high school PLTW BMS teachers participated in this study. All the participants taught in traditional face-to face institutions during their BMS instruction. Table 3 describes participant demographics. Summaries of each of the participants are given here.

Participant 1 teaches in a public school and has a master's degree with 13 years of PLTW teaching experience encompassing Medical Interventions (MI) and Biomedical Innovations (BI). Participant 2, a teacher in a public school has a BSN and a master's degree in education and is a national board-certified teacher (NBCT). Participant 2 has taught Human Body Systems (HBS) and MI for 17 years. Participant 3, with a master's degree, has been teaching PLTW for 8 years in a public school and has taught Principles of Biomedical Sciences (PBS) and HBS. Participant 4 has a PhD and has taught PLTW for 7 years and has been teaching MI in a charter school. However, Participant 4 has also taught PBS in a public school. Participant 5, with a master's degree, was also a PLTW Master Teacher. Participant 5 has taught HBS for 17 years in a public school. Participant 6 has a master's degree and has been teaching PLTW for 16 years in a public school. Participant 6 has been teaching PBS but has also been trained in HBS. Participant 7 has an EdD and has taught in the public sector for 18 years, teaching PBS, HBS, MI, and BI. Participant 7 has also earned PLTW Teacher of the Year 2 consecutive years. Participant 8, with a Bachelor of Science degree, taught PLTW for 8 years and teaches PBS, HBS, and MI in a private school. Participant 9 taught PLTW for 15 years in a public school and has a Bachelor of Arts degree and is a NBCT. Participant 9 taught PBS, HBS, and BI but

is also trained in MI. Participant 9 left the classroom to join administration as a career pathway coordinator. Participant 10 is trained in PBS, MI, and BI and has taught PLTW in a public school for 8 years. Participant 10 has a master's degree in education and is a national board-certified teacher (NBCT). Participant 11 has a Bachelor of Science degree and taught PBS for 2 years in a public school. Teaching 29-nine years, Participant 12 has taught PBS for 3 years in a private school. Participant 12 has a Bachelor of Arts degree and teaches chemistry and physics. Participant 13 holds a Bachelor of Arts and Bachelor of Science degrees and is a NBCT. Participant 13 taught PLTW PBS, and MI for 7 years. All participants must be trained in each of the PLTW courses that they teach. Twelve of the teacher participants are still actively teaching PLTW in their classrooms.

Table 3

Participant Demographics

Participant	School	Gender	Yrs Teaching PLTW	Degree	Levels taught	NBCT
1	Public	F	13	Master's	MI, BI	No
2	Public	F	17	BSN, Master's	HBS, MI	Yes
3	Public	F	8	Master's	PBS, HBS	No
4	Charter	M	7	PhD	PBS, MI	No
5	Public	M	17	Master's	HBS	No
6	Public	M	16	Master's	PBS, HBS	No
7	Public	F	18	EdD	PBS, HBS, MI, BI	No
8	Private	F	8	BS	PBS, HBS, MI	No
9	Public	F	15	BA	PBS, HBS, BI	Yes
10	Public	F	8	M.Ed.	PBS, MI, BI	Yes
11	Public	M	2	BS	PBS	No
12	Private	F	3	BA	PBS	No
13	Public	M	7	BA, BS	PBS, MI	Yes

Note: BSN = Bachelor of Science in Nursing, BS = Bachelor of Science, BA = Bachelor of Arts, M.Ed. = Master of Education, EdD= Doctor of Education, and PhD = Doctor of Philosophy. PBS = Principles of Biomedical Sciences, HBS = Human Body Systems, MI = Medical Interventions, and BI = Biomedical Innovations.

Data Collection

I received IRB approval from Walden University on January 17, 2025 (no. 01-17-25-0762840) and started the recruitment process shortly thereafter. For this study, I conducted a total of 13 virtual interviews in Zoom using the interview protocol described in Chapter 3. I collected data from 13 high school PLTW BMS teachers. Interviews were all approximately 30-45 minutes in duration. I used the video and audio recording features in Zoom. Data were transcribed via Zoom transcription. A transcription feature in Zoom delivers real-time captions during a meeting, along with a recorded audio transcript. In the Zoom settings, I enabled the "Live Transcript" option to view automated speech-to-text transcriptions. The audio transcripts were displayed during the Zoom session, and the transcripts were also saved separately in the cloud recording, and a backup of the transcripts and audio files were saved in an additional drive and cloud-based service with password control for additional security. To ensure maximum accuracy, the recordings were viewed with captions, and any errors were corrected as needed. I also performed reflective research journaling to mitigate possible bias. This was a way for me to track my thoughts during the interviews that included participant experiences and their feelings and thoughts on experiences that needed clarification for

the sole purpose of understanding my participants better and learning from them. This reflective journal was kept in a bounded book for future reference. There were no variations in data collection from the plan presented in Chapter 3.

Data Analysis

I used the software managements system Dedoose in combination with Microsoft Word. Both programs were simple to use as organizational tools. Data were broadly sorted into Keller's (1987) ARCS model of motivational design categories during the first inductive round of coding. I began with the a priori codes of attention, relevance, confidence, and satisfaction. Using a thesaurus, I included appropriate synonyms for each of the a priori codes using the Search tool in Microsoft Word. I also looked for additional emergent codes that were identified as significant that might be revealed in the data. The emergent codes included collaboration, teamwork, communication, expose/exposure, hands-on skills, soft skills, critical thinking, and creativity when using the PLTW BMS coursework. These emergent codes were filed under the a priori codes according to how they were associated in the participants' narratives. Collaboration, teamwork, communication, and soft skills were associated most with relevance. These emergent codes were used most when describing the relevance in what Hispanic students were immersed in and how these are essential job skills and professional skills that students must know how to use for career readiness. The emergent codes, critical thinking, expose/exposure, hands-on skills, and creativity were associated with the a priori code, attention. According to the data analysis, all these engaged the students to bring attention to what they were learning while capturing and maintaining their interest. As the data

showed, these emergent codes, while sparking their attention, also built Hispanic students' confidence and made their learning relevant while helping them feel successful. Three rounds of coding were completed to understand how career exploration programs influence the motivation of high school Hispanic students and may help enhance social change by increasing engagement, motivation, and academic achievement among their middle school counterparts.

I used Dedoose, a qualitative research software, in combination with Microsoft Word and Microsoft Excel. As part of the first inductive round of coding, data were categorized according to Keller's (1987) ARCS model of motivational design categories. Initially, I focused on the a priori codes of attention, relevance, confidence, and satisfaction. However, I also investigated whether other significant codes may have emerged because of my data analysis. Emergent codes included collaboration, teamwork, communication, critical thinking, and creativity when using the PLTW BMS coursework. Table 4 shows the first round of codes, and the number of responses found in the interview transcripts. The second and third round of coding included a priori codes and categories and themes respectively.

Table 4

First-Round Codes and Number of Responses

Code	Total no.
Attention	14
Engage	42
Aware	22
Application	12
Interest	56
Relevance	19
Significant	15
Important	21

Code	Total no.
Connection	37
Meaning	15
Real-world	18
Applicable/apply	16
Confidence	46
Belief	4
Trust	4
Empowerment	16
Assurance	14
Satisfaction	4
Enjoyment	27
Pride	8
Success	15
Collaboration	9
teamwork	6
Communication	11
Critical thinking	9
Expose/exposure	9
Hands-on skills	15
Soft skills	11

Round two of coding involved combining similar codes. During this process, decisions were made regarding the emergent codes. Collaboration, critical thinking, communication, hands-on skills, and soft skills were considered separate codes. When I analyzed the data, it was clear and reasonable based on participant responses that soft skills such as collaboration and communication were part of the relevance code. For example, Participant 5 discussed communication and collaboration that captured the interest of the students:

> Soft skills are vitally important. With communication working as part of a team ability to meet deadlines. And then taking on various roles in the group and things like that. There are all those good components that often get overlooked in a high school setting.

Critical thinking and hands-on skills were determined to be unique in its usage during the interviews. Both vitally important in career exploration and pathways, it was determined that both could not be placed in a single category. Critical thinking and hands-on skills sparked the attention of the students making what they are learning more relevant while building their confidence. Critical thinking and hands-on approaches also appeared to satisfy students' choices regarding their future goals, according to teacher interview responses. For instance, Participant 10 mentioned hands-on experiences bringing more relevance to student learning. In the interview it was stated, "…they're doing lab tech work, or they're doing phlebotomy or things like that, to give them a real sense of what some of those hands-on skills would feel like in the workplace."

As part of the interview process, each participant shared multiple narratives in response to the interview questions. These narratives were closely connected, and it was necessary to carefully isolate the codes embedded in the recounting the participants' narratives. The narratives contained teacher anecdotes about the impact PLTW BMS courses had on Hispanic students academically and personally, including the observed effects. Additional secondary themes were formulated based on Keller's ARCS model, evolving into four single themes, one for each of Keller's four constructs: Attention, Relevance, Confidence, and Satisfaction. . One significant idea that emerged was the professional perspectives of teachers on the exposure to real-world skills and topics that students gained. Ultimately, the theme was considered closely related to Attention and Relevance. The participants mentioned that students were exposed to real-world scenarios that connected their existing knowledge and experiences to relevant

information, piquing their interest and continued engagement. Participant 6 confirmed this as mentioned in the interview, “They are correlating with what they're doing in the classroom to the possibilities in the real world.” Additionally, when asked about some components of the BMS courses they found that their students understood better because of the career exploration experiences, Participant 6 responded, “They’re seeing the meaning behind everything, and how that transitions into the real world.”

The third round of coding included an in-depth analysis of existing codes, including color coding to clearly describe the commonalities within the data. There was some convergence of the categories, and a determination needed to be reached regarding the best interpretation of the participants’ responses. There was also the use of deductive coding that confirmed the four initial a priori codes: attention, relevance, confidence, and satisfaction. Data for a priori coding must be examined thoroughly to make sure there is sufficient data available. This ensures that the data is accurately categorized and that any patterns or themes are properly identified. Additionally, the use of a coding framework allowed for a more systematic approach to data analysis, which helped to ensure that all relevant data was considered. Through the data analysis process, using the four a priori codes, I identified two categories for each of the a priori codes; Attention, Relevance, Confidence, and Satisfaction, with each category organized into four subcategories. There were four themes that originated from the data. Table 5 shows a summary of the final categories, subcategories, and themes for each of the a priori codes.

Table 5

Categories and Themes for A Priori Codes From Data Analysis

A priori code	Category	Theme
Attention	Engaged learning strategies	Students are engaged in unique, immersive learning activities.
	Hands-on experiences	
	Real-world simulations	
	Interactive scenarios	
	Unique, immersive activities	
	Attention triggers	
	Career narratives	
	Interactive studies	
	Practical skills	
	Exposure to diverse environments	
Relevance	Career connection strategies	Students link academic content to real-world applications.
	Linking academics to real-world	
	Demonstrate pathways	
	Showing career possibilities	
	Connecting learning to work skills	
	Relevant Structure	
	Patient/real-world scenario	
	Professional skills	
	Career exploration Interactions with professionals	
Confidence	Skill development	Students were engaged in progressively scaffolded skills,
	Skill scaffolding	
	Hands-on experiences	
	Incremental complexity	
	independent problem-solving	
	Confidence indicators	
	Technical competence	
	Communication skills	
	Self-directed learning	
	Complex scientific procedures	
Satisfaction	Motivational factors	Students felt a greater sense of professional achievement and meaningful learning experiences. .
	Career discovery	
	Professional achievement	
	Meaningful experiences	
	Skill acquisition	
	Satisfaction outcomes	
	Increased engagement	
	Career trajectory	
	Self-efficacy	
	Intrinsic motivation	

The ARCS model provided an overarching, in-depth framework for understanding how career exploration and career pathways can create transformative learning

experiences that engage, motivate, and prepare Hispanic students for postsecondary career preparation. The ARCS model emerged powerfully through the PLTW BMS curriculum experiences documented from the interview excerpts. The excerpts were summarized to create the categories and themes as noted in Table 5.

Discrepant Cases

There were no discrepant cases identified in this study. However, one participant was considered an outlier. The term "discrepant" is a point of conflict or difference between two or more sources of data (Merriam & Tisdell, 2016). This can occur between interview transcripts, field notes, or other qualitative data sets, and instead of being seen as a problem, it is often treated as a valuable opportunity to gain deeper insight by exploring why the data points diverge. The participant continued to focus their responses to the questions on the science in the BMS coursework rather than the career readiness and preparation that is the focus of this study. The participant was redirected when responding to some of the interview questions to refocus their responses.

Evidence of Trustworthiness

Credibility

To ensure the credibility of the study, teacher participants validated their responses from their interview using member checking. Once the transcripts were analyzed, I developed a one-to-two-page summary of the participants' interviews for review using a Google Doc. Using the Google Doc feature made it easier for me to send out to teachers using the school email they provided as most of the teachers use a Google-based platform. Google Docs offered the participants an opportunity to provide any

changes or updates in live time. This also allowed me to view their feedback and updates immediately. These summaries were emailed to each participant for member checking. I encouraged the participants to validate their responses from their interview, giving them an opportunity to review their responses and verify their answers. All participants reviewed their summaries and responded within a 24-hr period. Each participant received a summary of their interviews, which I asked them to review and correct, if necessary, as well as adding any additional thoughts. There were no discrepancies or additional information noted by any of the participants. As a result of this process, I was able to validate my understanding of the research and increased the trustworthiness and credibility of the study reaffirming the validity of the research findings. As a researcher, my goal was to verify and confirm the information provided was relevant to both the problem and the purpose of the study. As part of my commitment to transparency, there were no adjustments made regarding the credibility of the study. I openly communicated about biases, challenges during participant selection, and shortcomings during the coding stage.

Transferability

The detailed and rich descriptions of the participants' responses can serve as a basis for further research in this area to determine if the findings are transferable. As part of my commitment to the transferability in this study, there were no modifications or changes made. A description of my methodology, the selection of participants, and demographic takeaways regarding the PLTW BMS teacher participants are provided. The participants had diverse experiences teaching PLTW including different areas of the

PLTW BMS courses. While they all had PLTW BMS training and classroom instruction in common, some participants taught multiple PLTW BMS courses, and some taught only one BMS course. Among the information included in this section was the general location, the number of years of teaching experience, the skill levels taught, and the level of education the teacher held. I also included a discussion of how interviews were conducted, including the length of the interviews for each participant, and the interview questions used.

Dependability

Dependability refers to the fact that a similar study, but with different participants, would have similar outcomes. I have ensured that I followed my methodology, increasing the dependability of the study. Furthermore, to ensure the replication and confirmation of the results, I kept detailed notes using a reflexive journal regarding how I obtained the data and further understood and explained it. I also used member checks so the participants could ensure the integrity of their transcribed interviews. Though it is unlikely that an exact replication of a study can be performed, the information provided in this study allows other researchers to conduct a similar study. There were no adjustments made regarding the dependability of the study.

Confirmability

Confirmability provided certainty and removed doubt providing strength to the study. To maintain objectivity of the study, the research findings confirmed that the results with the participants' interview responses, and the collection of data using the a priori coding in addition to, and second- and third-cycle coding that ensured the

confirmability of the study. I made the decision as a researcher to put my personal biases to the side to look at only the facts about PLTW BMS coursework and student engagement and motivation. Participants' words were recorded and transcribed directly from the audio and video recordings as well as verifying using the close-caption feature. The preliminary number of results from the first round of coding are highlighted in Table 4. The second round of coding I identified categories and themes from each of the a priori codes Each of the a priori codes for attention, relevance, confidence, and satisfaction produced a total of eight categories and 24 subcategories, respectively.

Results

The purpose of this qualitative study was to explore high school teachers' perspectives of how middle school STEM career exploration programs motivate Hispanic students' interest in BMS careers. The phenomenon being studied was the PLTW BMS high school teacher perspectives of middle school STEM career exploration courses and how they motivate Hispanic students to continue pursuing BMS career options in high school. The research question asked was: What are high school teachers' perspectives on how middle school STEM career exploration programs motivate Hispanic students' interests in BMS careers? After completing the first round of inductive coding, a priori codes were chosen to narrow the focus. These a priori codes were directly connected to attention, relevance, confidence, and satisfaction as identified in Keller's (1987) ARCS model of motivational design. Table 6 highlights the a priori codes and their categories and subcategories from the first round of coding. Corresponding themes from the second round of coding are included as well as verbatim testimonials from the participants'

narratives sorted using the categories of attention, relevance, confidence, and satisfaction. Considering that all responses were provided by the stories of the participants, I left them in narrative form.

Table 6

Codes, Categories, Themes, and Participant Responses

A priori code	Category	Theme	Participant quote
Attention	Engaged learning strategies Hands-on experiences Real-world simulations Interactive scenarios Unique, immersive activities Attention triggers Career narratives Interactive studies Practical skills Exposure to diverse environments	Students are engaged in unique, immersive learning activities.	[PLTW] excited them in completing classwork because it is so tied to real-life stuff that is very technical.
Relevance	Career connection strategies Linking academics to real-world Demonstrate pathways Showing career possibilities Connecting learning to work skills Relevant structure Patient/real-world scenario Professional skills Career exploration Interactions with professionals	Students link academic content to real-world applications.	[PLTW] bridges the gap between the really academic theoretical topics that we have to the real world.
Confidence	Skill development Skill scaffolding Hands-on experiences Incremental complexity Independent problem-solving Confidence indicators Technical competence Communication skills Self-directed learning Complex scientific procedures	Students were engaged in progressively scaffolded skills,	It [PLTW] prepares them for more, prepares them for each subsequent class.

A priori code	Category	Theme	Participant quote
Satisfaction	Motivational factors Career discovery Professional achievement Meaningful experiences Skill acquisition Satisfaction outcomes Increased engagement Career trajectory Self-efficacy Intrinsic motivation	Students felt a greater sense of professional achievement and meaningful learning experiences.	There's empowerment with all students, with all abilities, and a lot of pride.

Engagement in Unique, Immersive Learning Activities

The first theme, students are engaged in unique, immersive learning activities, was related to the a priori code of attention which had two categories and eight subcategories. These categories included engaged learning strategies and attention triggers. The data analysis clearly identified hands-on experiences, real-world simulations, interactive scenarios, and unique and immersive activities and learning strategies that engaged students learning and gained students' attention while getting them excited about the possibilities in BMS. The data also identified attention triggers using career narratives in the form of journals interactive studies, practical skills, and exposure to diverse environments as ways of keeping the students engaged and capturing their interest in what they were learning. All the participants interviewed highlighted the purposeful engagement of students at all levels (PBS, HBS, MI, and BI) in the PLTW coursework. Keeping an active interest for a significant period is what Keller (1979) describes as attention. When I analyzed the data with each category and subcategory, the participants confirmed the ideas they shared in their interviews.

For example, Participant 1 referred to the category, attention triggers mentioning the use of practical skills and career narratives keeping her students engaged. In the interview she shared, “My student says, ‘I really like the detective portion of that like, I wouldn't mind helping with a crime scene’, and ‘oh, I could kind of still be exploring these topics as a law enforcement officer, or as an engineer or as a statistician.” Students are naturally engaged when they see the benefits of what they are learning. Connecting academic content to a hands-on task or applicable life skill creates an attention trigger. Rather than presenting information as an abstract requirement, classroom learning is connected to students' real-world aspirations, making them more invested in the material. Additionally, Participant 9 referenced specific triggers, exposure to diverse environments and interactive studies that focused on keeping the attention of the students. In the interview Participant 9 mentioned “…helps students open their eyes and mind to possibilities. I think it really helps expose them to different healthcare career fields. It is something that challenges them, but is relatable enough to really help them learn, and then also incorporate other areas to help them just learn and explore.” Through scenarios such as these, students were more engaged because they were actively participating. This triggers the attention of students and has engaged them using interactive studies and exposure to diverse environments.

When referring to engaged learning strategies that utilized unique immersive activities, Participant 2 mentioned, “They're going to have to problem-solve. They're going to have to be critical thinkers on their own.” Problem-solving is an engaged learning strategy because it requires students to actively apply their knowledge to find

solutions to authentic, complex issues in the form of real-world simulations and interactive scenarios, in turn strengthens their critical thinking skills. Participant 11 also referred to interactive scenarios, real world simulations, and unique immersive activities as engaged learning strategies. In the interview, it was mentioned, "…the whole unit students are very engaged because each of them comes up with their own theory. It gains their interest and keeps them engaged. Also, their teamwork skills, their collaboration, and their communication improve when they're immersed." Engaged learning uses interactive scenarios, real-world simulations, and unique immersive activities to enhance the participation of students, while improving their retention, and developing their practical skills. The hands-on experiences transform the students into active participants while building their own understanding through direct experience and reflection.

Teachers responded positively and enthusiastically when summing up attention, especially student engagement. As mentioned by Participant 12 "…they're very immersed in everything, they're gaining a lot of knowledge. They're engaged and they see connections, interest, and determination. And they're finding success in what they're learning." Additionally, Participant 13 stated, "Experience in general is unique to these guys, so they see significance and relevance..." and "I think that it builds their determination, or their determination grows as they continue moving forward. It definitely maintains their interest." Engaged learning strategies and attention triggers allow students to sustain their active involvement in the learning process by connecting with them, capturing their interest, and motivating them. Engaged learning strategies also turn attention into sustained focus by using connections, interest, and determination.

Connection of Academic Content to Real-World Applications

The second theme is students linked academic content to real-world application. This theme had two categories and eight subcategories that were associated with the a priori code of relevance. This theme contained two categories and eight subcategories that linked academic content to real-world applications showing the value and the applicability of the learning experience. By demonstrating professional pathways and highlighting interdisciplinary career possibilities, it connects classroom learning to essential workplace skills. There was reference in the participant interviews that PLTW assisted with student concentration and student-led learning environments that motivated students who otherwise may not have been enthusiastic or seen the relevance in what they were learning. When I analyzed the data with each category and subcategory, the participants shared in their interviews the presence and need for relevance in student learning.

For example, Participant 4 referenced career connections by linking academics to the real-world and connecting students to work skills. In the interview the following insight was shared; “They enjoyed laparoscopy, because again, it's more translatable to real life. …they can touch and then they can relate to it if it is something that has happened in their family or what not. They're enjoying it more.” Career connections in the classroom integrated student learning with real-world experiences and applications. In addition to preparing students for life after graduation, it helped them develop practical skills to succeed in the workplace that is directed towards college and career. These real-

world skills have also opened windows of opportunity for students to relate to what may be happening in their everyday lives.

The demonstration of pathways and the possibility of careers when career connections were discussed and was admired by the participants in their interview responses. Participant 6 referenced the importance of demonstrating pathways to show the career connections and possibilities that students can focus on as a career. In the interview~~ed~~ Participant 6 stated,

> I think that the first unit with forensics is something that the kids really get into. They start with the crime scene and now where I have former students that are studying forensics in college. The first 10 to 11 weeks of starting, PLTW really pulls in the kids into the forensics unit, so they see the relevance. They are correlating with what they're doing in the classroom to the possibilities in the real world.

Through career connections, students are shown how real-world experiences and expert guidance helped them be successful. Instead of learning about a topic, such as forensics, students applied real-world skills and also saw how other academic subjects were applied to the profession. A broad range of options can be explored, concrete steps can be taken to achieve goals, and students can find meaning in their learning.

Relevant structure was referenced in the interviews that focused on professional skills and interactions with healthcare professionals. Participant 13 spoke to this in during the interview and mentioned the importance of the opportunities that the students have

had because of the PLTW career pathway and career exploration. In the interview they mentioned,

> I'd say they're well experienced in Project Lead the Way and in generic employability skills, in career tech. With the seniors and their mentorships, they have 50 hr of real hands-on clinical time. They're not necessarily laying hands on patients, but they are watching everything that happens in the progressive care unit or everything that happens in the cancer treatment center. So, their experiences. I'd say, are at the top percentile for high school.

This structured approach to relevant learning and career exploration included professional skills training and professional interactions for students. This helped the students transition from simple theoretical knowledge to a real-world, practical understanding, which helped them make informed decisions and build a professional network. This framework transformed the students' learning process from passive research into an active and dynamic journey.

Structured relevance in the classroom has brought learning to life for students in career pathways. Participant 2 spoke about how her students have opportunities to explore different healthcare careers through research and career journals. She mentioned the importance of career exploration and research as part of the classroom learning experience for students during her interview. During the interview she stated,

> We explore a lot of careers, and they do a lot of career journals. We'll take different career journals and learn about it, and they'll talk about it and then they'll do a little reflection on whether they like the job, or whether they think it's hard.

A cycle of introspection and investigation was a structured approach to career exploration for Participant 2 in her classroom. Career journals provided her students with self-reflection that identified personal interests and values, and their research offered opportunities to evaluate potential career paths.

Another example of structured relevance in the classroom was patient scenarios. This allowed students to make connections and meaning to real-world situations through application and hands-on skills. Participant 10 spoke about the opportunities that students are given that were focused on patient scenarios. She discussed the real-world relevance and the hands-on learning that the BMS pathway brought to the forefront for her students. During her interview she stated,

> The courses put them in the shoes of some careers where they're doing lab tech work, or they're doing phlebotomy or things like that, to give them a real sense of what some of those hands-on skills would feel like in the workplace. I think it brings more relevance to their learning within the context of what we were doing at the time with Project Lead the Way. They realized the importance of what they were doing and how it applied to what they were interested in.

Patient scenarios and real-world scenarios were critical components of a relevant career exploration structure for Participant 10 in her classroom. These simulations offered an experiential learning approach for her students that bridged the gap between classroom knowledge and practical application.

Engagement in Progressively Scaffolded Skills

The third theme, students are engaged in progressively scaffolded skills cultivating both competence and self-assurance, displayed two categories and eight subcategories respectively that were associated with the a priori code Confidence. Students' confidence levels are tied to the opportunities they must succeed as they learn (Hiğde & Aktamış, 2022). Skills development was highlighted consistently in the data analysis specifically with skill scaffolding, hands-on experiences, incremental complexity, and independent problem-solving. There were also confidence indicators that were identified including technical confidence, communication skills, self-directed learning, and complex scientific procedures. The data analysis showed that students used reinforced and repeated hands-on laboratory experiences and activities, the complex tasks and opportunities offered to students helped them to become independent problem solvers. Multiple examples of student self-confidence were noted in the participants' interviews. Skill development was noted in many of the interview responses as a confidence builder for students. Participant 13 highlighted the hands-on experiences and the and the incremental complexity of the lessons that his students are presented with in class. It was stated, "They are getting their hands on a sphygmomanometer and doing blood pressure work and going through the basic vital signs, charting them, all of that. I think that they were really engaged in that process because they felt directly like they were participating in a healthcare career." Hands-on learning and incremental complexity are essential for developing skills that are both ingrained in the curriculum and practical for students that would keep their attention and maintain engagement.

Skill development also included scaffolding of skills to build students' confidence and problem-solving that was naturally built in promoting independent thinking and solutions offered up by the students. Participant 5 spoke about this in much detail during his interview. He stated,

> That's kind of like a big Aha moment for them. So, this is what this feels like. Now I'm like a real physical therapist, and I have a patient, and this patient has arthritis, or this patient, is coming back from a broken arm and this is how I must rehab them. This is the workout plan that I'm going to create, and these are some modifications I'm going to do for that workout plan so my patient can meet their goals. You see their confidence, building, and growth in their learning.

This example described how developing skills required scaffolding and independent problem-solving to help students move from guided practice to self-directed mastery. Using scaffolds helped his students learn new concepts and skills, while independent problem-solving developed their confidence to apply those skills in new situations.

Confidence indicators that played a huge role in student learning in a BMS career pathway were self-directed learning and communication. Participant 7 shared some of these aspects during her interview. She mentioned how job shadowing helped one of her students solidify their decision of becoming an orthodontist. She stated,

> Clearly, she knew what an orthodontist did because she went to one. But because of this experience she saw a different side of it. So not only did the shadowing led to a job for her… she is actually going to dental school now. She really found her passion... she knew she liked healthcare but didn't really know what she liked. She

> was one of my less focused students, very sociable, and I don't think she would have flourished in a more traditional teacher-centered program. But in this way, she has just done amazing things. So, it built up her self-esteem where she was determined, and believed in herself, and empowered her.

Self-directed learning required the student to communicate that in exchange they built self-confidence or believing that they can be successful. The student took charge of her own learning therefore demonstrating confidence in her own capacity and navigated the challenges presented to her, managed her own process, and mastered new skills independently.

In addition to communication and self-directed learning, technical competence was mentioned as a confidence indicator in the classroom experience. Participant 3 highlighted the technical aspects of the career exploration experience within the BMS coursework. She stated, “They’ve kind of seen some doors open to be able to get a better idea of where they're going and what they can do, which I think excites them in completing the classwork because it is so tied to real life stuff that is very technical.” Furthermore, part of building student confidence has involved complex scientific procedures that the students otherwise would have thought possible. Participant 8 was very specific to this in her interview. When speaking about a student and her experience she mentioned,

> seeing everything that we've done in class and all these careers that we've learned about, she's seeing people doing procedures at this lab, and she'll come back and tell me ‘…today we tested blood, and we grew microbes.’ It’s just amazing what

> they're able to do in these internships, and they make that relationship between what they learned and what they are observing. It's empowering and there's pride because they know they can do this.

Students following a complex scientific procedure exudes confidence. Scientific procedures are methodological and rigorous. The student that Participant 8 spoke about was able to recognize procedures that were learned in the BMS coursework. This built assurance and empowerment because she understood the process presented.

A Greater Sense of Professional Achievement and Meaningful Learning

The fourth theme, students felt a greater sense of professional achievement and meaningful learning experiences that emerged through personal career discovery, leading to the tangible acquisition of valuable skills, displayed two codes and eight subcategories and addressed the final a priori code satisfaction. Motivational factors were identified in the data analysis. Students felt accomplished in personal career discovery and professional achievement throughout their learning. This was because of the meaningful learning experiences and because of the tangible skills that they were able to acquire. The data analysis highlighted some vital satisfaction outcomes because of the BMS coursework. The narratives were consistent in mentioning increased student engagement, developing a clearer career trajectory, enhanced self-efficiency, and an intrinsic motivation for learning. Whether students are satisfied with their experiences is indicative of the relationship they have between what is learned and what they expect. The distinction between confidence and satisfaction is that confidence is primarily internally focused on their capability. Satisfaction is the apparent acknowledgment of a job well

done with both the action and the results. This was supported by the perspectives of the participants regarding student satisfaction after finalizing their labs, activities, and projects.

When speaking about satisfaction, it was clear that meaningful experiences were an emerging category amongst the participants. Participant 11 spoke to this in his interview as he highlighted the multiple opportunities that his students were able to experience. Of the many he mentioned in his interview, the following stood out. He stated,

> The labs that we do are unique, I think, for a high schooler to experience. One good example could be the gel electrophoresis lab, but I also think the toxicology lab is wonderful and is something unlike anything that they would do in a biology class. I think the blood typing lab and being able to see the agglutination reactions, again, that is not something that they would do in a biology class.

To maintain student motivation long-term, it is critical that career exploration programs help to seek sustained performance and meaningful experiences that provide the intrinsic rewards that our students desire for long-term and sustained satisfaction. While other components may have captured initial interest and built student confidence, meaningful experiences have ensured that students feel a genuine sense of accomplishment and find value in the effort they have invested, which reinforced the desire to continue engagement in their learning.

Career discovery and a clearer career trajectory were motivational factors that aided in student satisfaction. This was mentioned by many of the participants during their

interviews. Participant 8 was very excited to discuss the students' career discoveries during her interview. She talked about the different careers that the students discovered that they did not know about. In her interview she explained her students' reaction to new careers, "We just got into talking about different types of careers in relation to the eye. And then they're like, oh, I didn't know there were, you know, three, four, five different career positions in the eye.' So, then they can ask questions, and then we dig into that a little bit more." Discovering new careers that were unknown to many of her students set up a clear career trajectory that grabbed their attention, increased their engagement, and harnessed their excitement. This excitement created a sense of purpose for their learning, kept them engaged, wanting to learn more, and motivated them to continue on that path of discovery. They were more engaged and committed to their roles, which translated to higher morale and contentment.

Satisfaction outcomes were clear when speaking to students' self-efficacy and intrinsic motivation. Participant 1identified both as she spoke highly of her past students who had completed the PLTW BMS coursework. Now in college, these students explained how the classes prepared them for their freshman science courses. In her interview, Participant 1 stated,

> The biggest feedback we get from our freshmen in college the following year is that their professor will say, "Okay, grab your pipetters", and they've told us, you can tell a kid who's been through Project Lead the Way because they'll open the lab supply drawer and grab a pipetter. College lab work isn't necessarily a career

> yet, but it's preparing them for a career to use all these materials. They have a jumpstart on everybody else.

Because of the learning that took place in high school, this opportunity presented to them in college gave them the ability to understand what their professor was talking about, and they identified specific lab equipment that was needed for their lab. This automatically self-directed the students and motivated them to take control of their learning at that moment. Through self-efficacy and intrinsic motivation, the students were able to enjoy the activity, resulting in a sense of mastery and competence. Because the students had high self-efficacy due to their training in BMS careers during high school, it intrinsically motivated them to achieve the goal that was put in front of them. This led to enjoyment and satisfaction.

Students' professional achievement has also taken center stage as described by the participants in their interviews. Participant 3 identified this in her interview when talking about one of her senior students. She discussed how one of her seniors was struggling with what she wanted to do as a future career. However, after completing a few of the BMS courses, she identified with some of the different careers presented to her in the program. In her interview, she explained the direction that her senior student took. "…she wanted to do something in science, but she had no idea what." She continued, "With seeing some of the different careers that we've talked about in PBS and HBS she decided specifically that she wants to go into forensic science. She's already been accepted into Washington University…for next year…and PLTW kind of helped her figure out exactly what pathway she wanted to go into." The professional achievement that the student

experienced motivated her and provided her with a sense of accomplishment. This built her confidence in setting goals and encouraged persistence toward her career development goals.

Acquiring tangible skills is another motivational factor that attributes to satisfaction. The more students can make connections with what they are learning to personal experiences and interests, the more likely they are to be active learners and retain knowledge. Many of the participants mentioned in their interviews that students acquiring tangible skills during learning was a motivational factor for them as they continued through the BMS pathway and after high school. Participant 9 mentioned in her interview that students return from college with a sense of satisfaction because of what they learned in the BMS program. Participant 9 stated

> When they come back from college and they say, 'oh we did this in this class, and I remember it when we did it in your class'…those experiences are helpful in that it helped to set a foundation for them. So even though maybe we didn't go as deep with certain things as they do at the college level, it still set a foundation where it was familiar to them that they could remember learning about it, and I think that helped them accelerate in their overall success, in their college courses, and their future career.

Acquiring the necessary skills in high school was a powerful motivational factor for students as mentioned by Participant 9. Skills-based learning directly increased student self-efficacy and competence and provided clear evidence of progress.

Discussion of the Results

The purpose of this qualitative study was to explore high school teachers' perspectives of how middle school STEM career exploration programs can motivate Hispanic students' interest in BMS careers. Using Keller's ARCS model as the framework for this study, I wanted to focus on answering the following research question: What are high school teachers' perspectives of how middle school STEM career exploration programs motivate Hispanic students' interest in BMS careers? The perspectives of the high school PLTW BMS teachers were important as their responses to the final question helped to identify if middle school STEM career exploration programming would be beneficial to middle school Hispanic students' interest in BMS careers and motivating them to continue through high school. Focusing on the ARCS motivational model framework, this was supported by the perspectives of the teacher participants when responding to the final question; "Thinking about your students PLTW BMS experiences, give me some scenarios of how your students would benefit from beginning career exploration in middle school before starting the PLTW BMS pathway in high school".

The interview data within each unit of data analysis showed that participants confirmed their ideas when they answered the final interview question about STEM/BMS career exploration in middle school, when analyzing their responses. For example, Participants 3, 4, and 5 identified with the theme, students are engaged in unique, immersive learning activities that encompassed the Attention component of the ARCS model. There were also strong elements relating to the Relevance and Satisfaction

components. The participants focused on stimulating student interest and excitement, which is the core of the Attention construct. Offering career exploration in middle school that would offer challenges or mysteries to be solved would naturally stimulate student curiosity and mental engagement. In addition to offering the career exploration component in middle school, the participants believed that it was important to capture and sustain the interest of students so they could see the relevance and it "gave them a taste" of what they would expect in high school, making learning more meaningful, and benefiting the students by keeping them involved more in things while in school. Engaging students in unique and immersive learning activities aligned with students' intrinsic desire for achievement, and the real-world career narratives that got them excited for learning. Table 7 provides participant quotes from the interviews that best described the data that were coded leading to the theme that pertained to attention.

Table 7

Participant Responses Corresponding to Theme 1

A priori code	Category	Theme	Participant quote
Attention	Engaged learning strategies Attention triggers	Students are engaged in unique, immersive learning activities.	"If they're able to take something like Medical Detectives course and learn a little bit about PLTW would help grow more student interest. It would get them excited in middle school. They're seeing the relevance and are exposed to more jobs." (P3) "If they presented some of these careers, in an understandable manner in middle school, it would be more relevant for them with frequent repetitions and excite them to keep moving and work harder in high school." (P4)

The second theme, students linked academic content to real-world applications, corresponded with the Relevance construct of the ARCS model. Many of the participants interviewed established relevance as a key component for the need for middle school BMS programming. The participants emphasized the usefulness of teaching "transportable skills" throughout middle and high school. They also highlighted how these skills are not just for the immediate academic context but are valuable for long-term success "as juniors, seniors, and adults". The participants mentioned that the connections middle school students make are learned focused on their future goals and life outside of school as a key strategy for establishing relevance.

There was also a strong connection with relevance and the development of student confidence in what the participants stated in their interviews. They connected the teaching and emphasized these skills directly to the students becoming "more successful". The relevance of learning transportable skills that are useful in the real world builds confidence. By focusing on and reinforcing these relevant skills, students built up their confidence in their abilities. This created a cycle where their motivation was sustained by seeing how their effort led to real-world success. Table 8 provides participant quotes from the interviews that best described the data that were coded leading to the theme that pertained to relevance.

Table 8

Participant Responses Corresponding to Theme 2

A priori code	Category	Theme	Participant quote

Relevance	Career connection strategies Relevant structure	Students linked academic content to real-world applications.	"If we could somehow give some of those experiences to middle schoolers so that they know that they don't have to just focus on one thing, they can focus on multiple things that they enjoy. I think it keeps them involved in more things in school, too, which we all know is beneficial." (P1) "I think a middle school program can get them excited with things to look forward to and things to continue learning about like the possibilities and starting to treat them like young adults, in the sense they can start thinking more critically about scenarios, about different possibilities." (P9) "Soft skills such as communicating and having a conversation and collaborating with somebody, teamwork, are important along with their confidence, trust, and connections. Focusing more on those skills in middle school would help with career pathways in high school." (P12)

A theme emerged from the Confidence construct of the ARCS model. It was highly noted from the participants that students were engaged in progressively scaffolded skills that assisted with skills development and indicated a growth in student confidence in their learning. Many of the participants identified across multiple components of the ARCS model, primarily Confidence and Relevance, with contributing factors from Attention and Satisfaction. It was described in interviews that early exposure to career and technical education in middle school ultimately prepares students for high school. Because students would already have the background knowledge from their middle

school experiences, the high school material would be less intimidating. This familiarity increased their belief that they can succeed in the classes. It was mentioned during the interviews that starting students earlier in middles school could give them a stronger foundational knowledge leading to more confidence moving forward. A solid foundation for knowledge bolstered students' self-efficacy and made them more likely to engage and persist in learning.

Relevance was also a contributing factor when speaking about student confidence. It was noted that the middle school experience can help students see how the high school courses are connected to their interests and their future career goals. This was a direct connection with another ARCS component, Relevance. In addition, it was stated that because of the possibility of prior exposure, students may grasp the purpose and the value of their high school subjects. Understanding the "why" behind their learning made the content more meaningful. Finally, school subjects linked to potential careers and future applications were a key strategy for establishing relevance and building confidence. Table 9 provides participant interviews that best described the data that were coded leading to the theme that encompasses confidence.

Table 9

Participant Responses Corresponding to Theme 3

A priori code	Category	Theme	Participant quote
Confidence	Skill development Confidence indicators	Students are engaged in progressively scaffolded skills.	"If they were taught transportable skills in middle school and continued to be emphasized in the freshman and sophomore years, I think they would be more successful as juniors, seniors, and adults. We can better our students by 'growing' them." (P2) "I would say they certainly have more background knowledge, which leads them, I think, to have more confidence in the class that leads them to more questions, and then I think it even kind of brings them up to the next level." (P8) "I'm quite proud… We do have all the PLTW Gateway classes. They do the 9-week rotations. So, I feel like that by the time we get them as freshmen, sophomores, and juniors. It's not, you know, brand new to them. They did interest surveys in middle school. They've had some instruction on career pathways before they got to us. So, they identify with our courses more. They have a better understanding of the meaning in the courses…I know that they're attracted to the STEM idea." (P6)

Participant 7 spoke to Satisfaction, the final construct in Keller's ARCS model, the most during the interviews. It was mentioned in the interview that students could possibly "take some more pride in their learning" if they saw the significance and

meaning behind what they were learning in middle school. Students feeling pride in their learning could be a powerful intrinsic reward for them, which was a key element of the Satisfaction component. Satisfaction focused on providing intrinsic and extrinsic rewards validating achievements and encouraging continued motivation (Keller, 1987). When students took pride in their work, they found it inherently rewarding, reinforcing their motivation to learn and apply new skills. Table 10 provides the participants' interview response that best described the data that was analyzed leading to the theme that embraced satisfaction.

Table 10

Participant Responses Corresponding to Theme 4

A priori code	Category	Theme	Participant quote
Satisfaction	Motivational factors Satisfaction outcomes	Students felt a greater sense of professional achievement and meaningful learning.	"They would see significance and meaning behind what they're learning in a middle school class and maybe something to look forward to in high school. So, they start to see the success they can have and maybe take some more pride in their learning while they're still in school." (P7)

Satisfaction identified the theme, students felt a greater sense of professional achievement and meaningful learning, had a minimal focus when it came to BMS career exploration in the middle schools according to the participants' interview responses. However, many of the participants' responses contained strong elements relating to the Satisfaction component of the ARCS model. For example, Participant 3 mentioned in her interview that when students enjoyed a class, they wanted to "learn more about it."

Again, this feeling of intrinsic reward and enjoyment pointed to the Satisfaction component. She described a student's feeling that a course "was really cool." This internal feeling of enjoyment and accomplishment was a powerful intrinsic reward that reinforced the student's motivation for future learning. Additionally, students who saw the real-world connections and job possibilities in field of interest, especially at a younger age, served as a natural consequence that made the learning experience more rewarding and fulfilling.

Participant 6 also had a response that contained strong elements relating to Satisfaction. It was mentioned that he was "quite proud". While the quote is from the educator's perspective, it indicated an instructional strategy that led to the satisfaction for his students. When students are prepared and successful in their classes, they gain a sense of accomplishment and pride in their learning, which reinforces their motivation. By providing students with a foundational understanding and helping them identify personally with course content, middle school BMS career exploration can create a motivational cycle where relevance and attention can lead to an increase in confidence and a rewarding learning experience for students. Participant 9 reiterated what the other participants had mentioned that "the idea of a middle school program could get students excited and give them something to look forward to and continue learning about like the possibilities and starting to treat them like young adults." The excitement and prospect of learning about interesting career possibilities can lead to intrinsic satisfaction, as students could feel rewarded by the learning process itself.

Summary

This study focused on one central research question: What are high school teachers' perspectives of how middle school STEM career exploration programs motivate Hispanic students' interest in BMS careers? This research question was addressed by Keller's (1987) ARCS model of motivational design. It served as the conceptual framework that formed the basis of the four a priori codes that led to two categories and eight subcategories for each a priori code respectively. which led to four themes that addressed the research question: (a) engaged in unique, immersive learning activities that bring education to life, (b) linked academic content to real-world applications, (c) engaged in progressively scaffolded skills, and (d) greater sense of professional achievement, and meaningful learning. In chapter 5, An interpretation of the findings will be addressed, a discussion of the limitations of the study, and recommendations for further research, including implications, and conclusion.

Chapter 5: Discussion, Conclusions, and Recommendations

The purpose of this basic qualitative study was to explore high school teachers' perspectives of how middle school BMS career exploration programs motivate Hispanic high school students' interest in BMS careers. High school teachers provided insight into the motivation of high school Hispanic students who previously completed middle school STEM career exploration programs compared to those who did not to pursue BMS career pathways in high school. The literature explores BMS career exploration and pathways, in particular Project Lead the Way, and its role as a motivational teaching methodology that engages students in the BMS and healthcare career fields.

The focus of this study was to capture the perspectives of high school BMS PLTW teachers who provide services to Hispanic students enrolled in high school BMS courses and may or may not have completed the PLTW Medical Detectives course in middle school. During individual interviews, teachers shared their perspectives describing how their students' involvement in the BMS courses and possibly a middle school career exploration program influenced their interest in BMS and healthcare careers. They continued their learning in high school PLTW BMS courses because they identified themselves as career oriented. While career exploration and career pathways have been primarily used in high schools, little is known about the influence of middle school experiences in STEM career exploration that can encourage Hispanic students to pursue BMS careers. To address this gap in the literature, I conducted individual interviews with high school PLTW BMS teachers. I used semistructured, open-ended

questions to learn about the motivational effects of BMS career exploration, specifically PLTW, with their Hispanic students.

This study focused on the research question: What are high school teachers' perspectives of how middle school STEM career exploration programs motivate Hispanic students' interest in BMS careers? There were four themes that emerged from the data. These themes were as follows: (a) Students are engaged in unique, immersive learning activities, (b) Students link academic content to real-world applications, (c) Students are engaged in progressively scaffolded skills, and (d) Students feel a greater sense of professional achievement, and meaningful learning experiences.

In their stories about their students' classroom experiences, teacher participants stressed how career exploration, particularly the PLTW BMS curriculum, motivated their Hispanic students. According to the results, most students had a positive experience in the BMS classroom and were enthusiastic about pursuing a BMS-healthcare career after high school. Additionally, the results revealed that some students decided that BMS-healthcare was not in their future. However, they were grateful for taking the BMS courses because the courses helped them realize that their future was taking a different direction.

Interpretation of the Findings

According to the findings, four key themes emerged regarding career exploration and PLTW BMS as a motivational classroom strategy. Even though there is a minimal amount of research on middle school BMS career exploration programming or pathways as a form of feedback, it has been examined in high schools and as middle school

summer enrichment programs and that research will be used as a reference unless otherwise stated. These results were interpreted based on the themes that arose from the ARCS constructs (Keller, 1987).

Engagement in Unique, Immersive Learning Activities

Levels of attention, specifically engagement and interest, were associated with the PLTW BMS coursework emerged as a strong a priori code. According to Bacca et al. (2018), attention refers to holding the interest of students and keeping them curious about what they are learning. The findings of this study confirmed and extended the current literature by identifying that BMS-healthcare career exploration at an early age increases the motivation of Hispanic students to want to pursue these careers. There is evidence that middle school career exploration programs that highlight STEM career options are counteracting this decline (Albritton et al., 2020). Participants in this study recognized that their Hispanic students' experiences in middle school immersed them in engaging experiences that kept them interested and made them more aware of what the career field had to offer. Additionally, it was identified that these career programs exposed Hispanic students to a wide range of BMS careers, sparking interest and enthusiasm at an early age. They also helped Hispanic students identify and develop relevant skills, preparing them for college and career success. Considering the increase in Hispanics in the United States, encouraging young Hispanic students to pursue STEM fields early in their education is critical (Thomas & Larwin, 2023). The challenging part of classroom learning is to grab their attention during instruction so they can stay engaged while learning (Keller, 1987). It has also been found that students' academic engagement is

positively related to their future educational pursuits, positive self-esteem, high academic achievement, and positive classroom behavior (Thomason & Hsu, 2024).

A student's persistence in BMS at a postsecondary level is affected by his or her middle and high school learning, specifically when taking advanced mathematics and science classes (Jong et al., 2020). To keep students engaged and motivated, a variety of strategies can be used, including visual aids, explicit explanations, and regular feedback (Stieha et al., 2024). Furthermore, several factors influencing students' decision to pursue scientific careers have been addressed by well-designed comprehensive out-of-school science opportunities that are relevant to them (Barongan et al., 2023). It is imperative that we provide students with hands-on experiences, mentoring, and other opportunities in authentic settings to improve student attitudes and self-efficacy about science (Ihrig et al., 2022). Authentic settings allow students to apply academic knowledge to career scenarios that deepens their knowledge and clarifies what they are learning. These environments encourage active learning and critical thinking, helping students to build practical skills, and gain confidence. STEM career education, such as PLTW, can be effective with improving student interest and competence that may otherwise stop them from applying to STEM-healthcare programs in high school (Thomason & Hsu, 2024). Furthermore, engaging in authentic settings can improve students' motivation and interest in pursuing science-related careers (Ihrig et al., 2022). When Hispanic students see how these concepts are applied to real-world problems, they can relate more to what they are learning and the importance of the subject matter (Chen et al., 2024). Additionally, real-world application-based learning connected to careers helps to connect between the

subject matter learned and real-world scenarios. This hands-on approach can inspire Hispanic students to explore further and consider future careers in science fields (Kier & Blanchard, 2020). Having opportunities for Hispanic students to apply BMS and healthcare content to real-world situations is important for their success in entering these career fields.

Connection of Academic Content to Real-World Applications

The a priori code of relevance, specifically real-world experiences and relatability, had the greatest impact as discovered from the data. According to Keller (1987), relevance should be established using language that students understand and is linked to the material being studied. Furthermore, goal setting, motives, and relatability are strategies that Keller (1979) claims are necessary for relevance (Malik, 2014). The findings of this study confirmed the current literature presented in this study.

The data from the participants interviewed recognized that their Hispanic students were able to draw from additional real-world connections and observed how the BMS coursework played an integral part in everyday life for so many different people. Students were able to see the significance and meaning behind what they were learning. The connections they made to real-world healthcare careers were pertinent to what they were interested in and only confirmed that what they wanted to pursue was well within their reach. A greater number of diverse professionals in BMS-related fields would help contribute to innovations in medical research and treatment (Clayborne et al., 2021). Furthermore, when reviewing specific cases involving students in this study, participants recognized that their students' experiences immersed them in engaging opportunities that

were useful and explanatory, which kept them interested and made their career choices more desirable and meaningful. It is critical that students identified as underrepresented and as low socio-economic status need to earn an education and training to sustain a family in today's globally competitive world (Garcia & CLASP, 2019).

According to Gray et al. (2020), educational psychology interventions that make STEM content relevant to students' daily lives were found to be effective. This was confirmed in the participants' narratives that students made connections between what they learned in class to relevant experiences. Seeing an actual professional dealing with the same issue solidified that this is what is going on in the outside world with careers and real people's health. The data confirmed that students saw relevance in the BMS coursework. They connect with what they are doing in the classroom to the possibilities in the real world. Developing student-led learning environments, such as career exploration courses in BMS, are motivating students who might not be enthusiastic or think certain subjects are relevant to them (Chen et al., 2024). K. Li and Keller (2018) mentioned that because of the ARCS model, student learning is enhanced by motivating them through relevance while holding their attention and building their confidence. Students are motivated to engage with material when it is practical and relevant to their lives. Making content relevant to their lives allows them to see the relevance behind their learning. Teaching materials are indeed an essential component of today's education (Xueli et al., 2024).

Hispanic students' pursuit of scientific careers can be influenced by several different, well-developed informal STEM programs that take place in real-world settings

(Barongan et al., 2023). The PLTW BMS coursework and the career exploration opportunities provided to Hispanic students using real-life experience, dialogue about these experiences, and the availability of choice, they were able to acquire necessary job skills in preparation for future careers (Seevaratnam et al., 2023). The participants' narratives were consistent with their Hispanic students finding personal meaning in different problems presented to them focusing primarily on specific careers in BMS and healthcare in their BMS classes. The narratives from many of the participants specified that their Hispanic students were filling the shoes of healthcare professionals. They were doing something important associated with the problem that was relevant to their own experiences, or comparative to a career they may be interested in pursuing as a future career. For Hispanic students, STEM education is of paramount importance from a young age. (Jong et al., 2020). Additionally, to improving Hispanic students' academic performance and life skills, career pathways expose them to postsecondary education and careers (Ecton & Dougherty, 2022).

Sometimes relevance can take on a different role for students. Relevance for students can steer them in a different direction. This was indicative of the narratives from several participants. Participant narratives indicated that the relevant nature of the BMS coursework brought things into fruition for many of their Hispanic students. The study's findings also showed the other side of relevance for some Hispanic students who decided that this area was not the career path for them, and they were fine with their decision. Many study participants mentioned this to be reverse relevance and although their Hispanic students continued to learn and they understood the meaning behind everything

presented to them, they eventually realized that it was not for them. Many of the participants continued to note that although we want our Hispanic students to continue this journey into healthcare careers, sometimes it is beneficial to for them to learn that it may not be the pathway for them and that is okay. To make a permanent and lasting impact on STEM employment quality among Hispanic students, it is imperative to address attitude issues through career awareness and preparation programs that focus on interest, general education, and career pathways (Mulvey et al., 2022).

To achieve relevance, Hispanic students must demonstrate that the material is relevant to their lives, which includes their perception of how their learning in the classroom aligns with their future career goals (Chin et al., 2015). This reverse relevance was reiterated by many of the participants and the data further stated that the impact of the BMS courses brought the students' learning to fruition for them. The narratives were specific in specifying that the BMS coursework helped solidify that Hispanic students want to pursue BMS further, and for some others, it reinforced that they did not want to focus on certain BMS careers but became interested in others involving STEM.

Hispanic students have seen the relevance of the different careers outside of what they thought was health care. The participants in the study noted that the BMS coursework helped their Hispanic students decide in what direction they wanted to move towards. It is common for Hispanic youth to engage in future-oriented career behaviors due to misconceptions about various career options and perceptions of career obstacles (Thursby Bourke et al., 2024). They also learned that it was okay to change their minds. Future-oriented career behaviors are crucial as they help students, specifically Hispanics

and other underrepresented students, set goals and develop plans to achieve them that directs them towards their career goals and future success. By engaging in these behaviors, these students can better navigate potential obstacles and make educated choices regarding their career goals. Additionally, such behaviors encourage resilience and adaptability, which are essential skills in an ever-changing career field.

Nevertheless, a Hispanic student's desire to continually learn depends on their satisfaction with their learning experience (Stieha et al., 2024). According to Keller (2010a), students must have relevant experiences and achievements to develop self-esteem, interact with people, hear and respect their points of view, so they can overcome challenges that will improve their confidence. Relevance was a major component of this study. Because the participants' positive narratives regarding real-world experiences and their Hispanic students' personal experiences and feedback in the high school setting could be a key factor in middle school programs for Hispanic student to start them younger, catch their attention and excitement earlier, and possibly pique their interest in BMS careers.

Engagement in Progressively Scaffolded Skills

It was evident that confidence was a common theme in the participants' narratives of the participants regarding how their Hispanic students responded to the BMS coursework. The findings of this study confirmed and contributed to the current literature presented in this study. The data from the participants interviewed recognized that Hispanic students demonstrated determination and felt empowered because of the engagement and significance of what they were learning. They also observed how the

BMS coursework played an integral part in their Hispanic students' confidence and assurance moving forward in pursuing a career in health care. Confidence is built from opportunities offered to students that lead to success during their learning in school (Hiğde & Aktamış, 2022).

The participants' narratives clearly exhibited that a supportive learning environment encouraged their Hispanic students to take risks and learn from their mistakes without fear of judgment. Their courses also fostered a sense of acceptance and encouraged collaboration that allowed their Hispanic students to thrive both academically and personally. Keller (2016) observed that students' level of confidence influences their motivation to achieve performance objectives. The foundation of confidence is recognizing that students gain the skills and support for success.

The data clearly showed that Hispanic students' confidence was building as they continued moving forward in the BMS pathway. The data showed that many Hispanic students who completed the first class in the high school BMS pathway proceeded with the BMS course sequence. The data analysis also showed that many Hispanic students who completed the third course in the high school BMS pathway have decided to move forward in healthcare or the medical field after high school. The study participants specified this in their interviews as many of them continue following the students through high school graduation. Many of the participants also mentioned that they follow up with their students after graduation and some will return to visit and touch base with them during their college years. According to the data, there was an increase of high school

Hispanic students who saw the value in the pathway and were engaged and reminded of the reasons why they continued and persevered.

By achieving positive reinforcement and recognition for their efforts and successes, Hispanic students are motivated and confident in their learning (K. Li & Keller, 2018). It was also mentioned by the participants that their Hispanic students also saw the significance and the usefulness of the classes and were more aware as to why they made the decision to take those classes. Confidence is built when Hispanic students are given opportunities to succeed during their learning process (Hiğde & Aktamış, 2022). The participants specified that when they observed their Hispanic students feel confident with their capabilities, they were more likely engaged actively in their education, and they then took on more challenging tasks. Ultimately, building confidence early on can set the foundation for lifelong learning and success in their future educational and professional endeavors (Keller, 2016). As the need for STEM-skilled professionals grows globally, STEM education must also be diversified to include career paths that will benefit the global STEM market. (Coleman, 2020).

With a comprehensive career exploration program, such as the PLTW BMS coursework, Hispanic students gain valuable insight into themselves and their working environment (Oliveira & Araujo, 2021). According to Keller (2010a), students must experience their accomplishments so they can develop self-esteem, learn how to interact with others, respect their points of view, and overcome challenges that will increase their confidence. Furthermore, students must continue to be satisfied with the outcomes of their learning to continuously desire to learn (Kahraman, 2022). It was clear in the data

that Hispanic students need to have valuable experiences to make those empowering decisions on what they will do with their futures. The participants' narratives identified that their Hispanic students felt more empowered with the decisions that they had made and felt more decisive about their choices. It was also indicated that the BMS courses were self-selective, meaning they were not required that they took the classes. However, the data clearly showed that Hispanic students who elected to take the BMS classes trusted the process and felt assured and empowered that the decisions they were making benefited them moving forward. It's the motivation that drives human behavior, while playing a primary role in their education (K. Li & Keller, 2018).

The data also demonstrated that there was also a tremendous growth in student confidence including trust and making connections. As defined by ARCS, motivation is the leading variable in education that contributes to meaningful learning (Xueli et al., 2024). Furthermore, STEM education at a young age is extremely important for Hispanic students (Jong et al., 2020). As mentioned by Yelorda et al. (2021), minority students with a stronger connection and better intentions to progress academically, since self-efficacy and identity are key elements of pipeline programs. The data clearly demonstrated that the PLTW BMS courses did build confidence in students with observable pride and certainty. Furthermore, the data showed that the experiences Hispanic students had in their BMS learning, they found more self-confidence, self-assurance, and success in their careers through middle school career exploration programming. This was clear as they continued to move forward in the BMS pathway according to the participants' narratives. Due to the overall positive narratives and the

participants' perceptions from what they have observed from their Hispanic students' experiences, the need for middle school BMS career exploration programs should be further explored as an educational pedagogy to increase the Hispanic student interest in these careers.

A Greater Sense of Professional Achievement and Meaningful Learning Experiences

Satisfaction comes from feeling accomplished. When students feel satisfied with their learning, they receive positive reinforcement and recognition for their efforts (K. Li & Keller, 2018). This positive reinforcement was mentioned in the participants' narratives. The data identified that positive reinforcement boosted Hispanic students' motivation by increasing their confidence and encouraging them to continue engaging with their studies. It also created a rewarding cycle where their Hispanic students put in more effort and took on more challenges. As a result, it was observed that they developed a more resilient and persistent attitude towards learning. Keller (1979) stated that satisfaction is gained from the confidence that students gain through their learning ensuring that their accomplishments and efforts are recognized. The findings of this study confirmed the current literature presented in this study and contributed further to students' accomplishment and gratification when participating in the PLTW BMS pathway. The data analysis showed that the teacher participants recognized that students were reassured and felt a vast amount of pride due to what they accomplished. The participants' data analysis showed that the BMS pathway played a vital part in student satisfaction in pursuing a future healthcare career by providing a clear roadmap for

professional growth, increasing motivation and confidence, and ensuring alignment between their learning and their career goals. According to Xueli et al. (2024), satisfaction indicates the relationship between learning outcomes of students and their expectations. Additionally, Keller (1987) stated that satisfaction provides students with reinforcements for their efforts that are relevant and significant.

The data collected from the participants' narratives showed commonalities when focused on satisfaction. Participants data analysis demonstrated success and determination with all their students, both reflective and motivated, reaffirming the path they have chosen and igniting clarity for what comes next in the future. Students started to see the success they could have and took more pride in their learning. In addition, students enjoyed the activities more because they were more translatable to real life. Additionally, the data analysis showed that student communication had improved over time because of their excitement with what they were learning.

This communication not only included what was taking place with teachers and their peers but also with their parents and guardians. This was an indication of the pride they were feeling during their learning, and they displayed their excitement in sharing their success and gratification with others because there's that assurance there and that satisfaction that they're getting something out of this. According to Keller (1987) if students feel success while they work it gives them a sense of pride and accomplishment, therefore providing them with a need to continue their learning. Satisfaction is an emotional reward for students.

The data showed that it was observed that students demonstrated a sense of gratification, pride, and accomplishment that became prevalent in many students' journeys and milestones. Satisfaction and confidence are highlighted by focusing on relevance. The ARCS model enhances student learning through stimulation and motivation, while promoting satisfaction and confidence (K. Li & Keller, 2018). The relevance within student learning provided inner assurance leading to a high level of student satisfaction. Relevance enhances student learning, connecting with what they are learning to their own experiences (Stieha et al., 2024). This assurance instilled a sense of certainty whether they are on the right career path.

Career exploration and PLTW BMS also gave students a new perspective where they started to visualize their goals. The data analysis clearly shows that the PLTW BMS courses gave students assurance with their career choices as observed through student enjoyment and gratification. This was clear as they continued to finalize their decisions pertaining to postsecondary options focusing primarily on the biomedical sciences and the healthcare industries. The need for middle school BMS career exploration programs should be further explored to increase the Hispanic student interest in these careers as founded by the positive narratives and the data analysis from this study.

Research Question

The research shows the limitation of middle school career exploration throughout the United States and access to inquiry-centered learning for students, specifically those that are underrepresented minority students, is also rare (Kapon et al., 2023). Additionally, STEM-healthcare career knowledge is minimal for Hispanic students while

in middle school, which may result in a declining interest in BMS and healthcare careers. However, exposure to middle school career exploration programs highlighting STEM-healthcare career options appears to counter this decline (Albritton et al., 2020). Middle school represents a critical developmental stage for introducing students to diverse career possibilities in the biomedical sciences.

A consistent theme among the participants was the necessary assistance with middle school Hispanic students in gaining insight into the various BMS and healthcare careers, helping them understand the breadth of possible career paths, and breaking down narrow career perceptions in BMS and healthcare. Career exploration is an innovative teaching methodology in secondary schools, mostly in high school. The 13 participants interviewed in this study agreed that career exploration programs for Hispanic students, such as the PLTW Gateway Medical Detectives course, was a mutually beneficial and enriching learning experience in middle school that would bring the attention and excitement to the career field possibly attracting more Hispanic students earlier which confirms the literature in this study.

Career exploration is a factor in showing that students' learning motivation can be specifically aligned with their learning (W. Li et al., 2025). Additionally, Tsai et al. (2023) mentions that students begin to develop their career identities when they are still in middle school. Hispanic middle school students are interested in career and academic supports. Many look to their families for such support as they begin to set their future goals in motion (Albritton et al., 2020).

There were three key areas that were discovered in the data analysis that tied specifically to the literature that addressed the final interview question. Focusing on the need for middle school career exploration to motivate Hispanic students, these key areas included early exposure and career awareness, skill development, and engagement. The data analysis showed that middle school students, especially Hispanics and other underrepresented students, could benefit from BMS career exploration programs because they help set goals, make informed decisions about their education, and develop essential life skills. States have recognized that industry credentials are important in the education system's responsiveness to the new economy (Braxton, 2023). Additionally, the retention of Hispanic students in BMS related careers is vital because the inundation of diversity in these fields could help fuel the much-needed innovation in medical research and treatment (Clayborne et al., 2021).

The data analysis also showed that motivation influenced the effort and persistence that Hispanic students put forth into their studies, which directly impacted their academic performance. The data also clearly showed that when Hispanic students are motivated, they are more likely to engage with the material, seek help when needed, and apply effective study strategies. Therefore, performance in middle school is significantly correlated with students' learning motivation (Lee et al., 2021). This increased engagement and dedication can lead to better comprehension and mastery of information, ultimately improving their grades and overall academic success (Atin et al., 2022).

Because STEM-healthcare career knowledge is limited among Hispanic students, the real-world exposure in middle school highlights these career options and appears to counter the decline of Hispanic professionals currently seen in the workforce (Albritton et al., 2020). Increasing the number of Hispanic in healthcare and BMS is important in lowering the disparities in healthcare access, promoting research on these disparities, and producing Hispanic leaders in the healthcare field (Bhatt et al., 2020).

The data analysis clearly showed that starting the career exploration process for BMS and healthcare for Hispanic students in middle school is vital for this increase to happen. Middle school career exploration programs can provide a real-world context for learning, boost motivation by showing the relevance of their studies, and build a foundation for future success in a rapidly changing world (Thomas & Larwin, 2023). These initiatives are essential to promote the financial and social prosperity of Hispanic communities, harness the strengths of a diverse workforce, sustain an inclusive society, and uphold the moral and ethical responsibility to reduce inequities (Jong et al., 2020).

Limitations of the Study

There were a few limitations that may have affected the transferability and trustworthiness of this study. In Chapter 1, I acknowledged my bias and explained how I would attempt to mitigate it. These limitations included my perspectives and biases as a researcher. My role as a BMS teacher created bias, therefore my school district was not included in this study. I also used peer debriefing strategies and included detailed descriptions of the data that helped me confirm the findings and reaffirmed the validity of those findings.

I kept a reflexive journal, field tested the questions, shared my interpretations of the participants' interview responses, and was transparent in all my methodological processes. A second limitation of the study was the number of participant interviews that I acquired for this study due to the limited number of high schools BMS teachers who serve Hispanic students. Although this study's sample size was limited, it was feasible given the varying course offerings and the span of grades taught by the BMS teachers.

A third limitation was using individual participant interviews to encapsulate the teachers' perspectives who have Hispanic students. Probing questions were used during the teacher interviews to encourage a broader range of perspectives and insights. The last limitation was the transferability of the findings gathered in the study. To address this limitation, the study included a diverse group of PLTW BMS teachers from various educational settings and areas. This was to better understand how a middle school BMS career exploration program could potentially motivate Hispanic students to pursue healthcare career options; it was important to focus on the BMS teachers' perspectives and experiences.

Recommendations

I recommend additional research be completed to explore the potential impact of BMS and STEM career exploration in middle schools as schoolwide or districtwide programs. Every participant in this study spoke positively about the impact that middle school career exploration could have on Hispanic students as their observations of their current high school student responses to PLTW BMS coursework was positive. The participants also spoke excitedly regarding their experiences as BMS teachers and how

the coursework really brings real-world connections to the students that excite them to want to continue moving forward. Furthermore, research on middle school BMS career exploration programming is necessary and is based primarily on the results of the study.

Focusing specifically on the research question presented in the study, the findings from the BMS teachers interview responses noted that BMS career pathways and programs could benefit from vertical alignment with middle school to high school, and continued access to funding. Identifying the means necessary for schools and school districts to implement these programs in middle schools is vital for implementation to take place. Schools and school districts face multiple challenges with resources, and time specifically with developing career exploration programs and pathways. Additionally, as mentioned in the data analysis, finding the right teachers who are passionate about career exploration and readiness in middle school will make a positive impact on building a successful program that will engage and interest middle school students.

A third recommendation is the need for more research about middle school career exploration in general, especially with the biomedical sciences focusing on supporting Hispanic students and minority students alike. Because of the positive participant narratives and their shared responses from their Hispanic students, middle school career exploration could be further explored as educational programming to increase Hispanic student interest in BMS careers. A deeper understanding can be gained about the access to middle school career exploration and the challenges and barriers teachers, schools, and school districts face and how they overcome successful implementation and sustainability. It is also important to understand the impact that middle school programs

that are implemented are making on Hispanic and other underrepresented students. Additionally, it would be recommended to examine the impact current middle school career exploration has had on Hispanic students at the high school and postsecondary levels. It is imperative that there is collaboration between schools and workforce agencies so that they can understand that investing time in middle school career exploration pathways and programs is the ideal bridge to fill a much-needed shortage in the industry, including rural areas and high need career fields.

A fourth recommendation is to further research into how PLTW BMS career programming affects teachers. The data analysis identified the enthusiasm of the participants when discussing the observations and perspectives they have made regarding their students who have taken their classes. Each participant shared several stories about student engagement and performance, but the constant overarching tone was pride in the accomplishments of their students as well as joy that they got to participate in this learning adventure. The satisfaction of teachers with their students' performance, their own careers, and their involvement in PLTW and career pathways are just a few topics that could be explored.

Implications

Many levels of positive social change are supported with middle school career exploration in BMS and the impact this type of programming can have on Hispanic students learning and future goals. The development and demonstration of academic and personal skills take place on an individual basis for each Hispanic student (Chen et al., 2021). With these skills, Hispanic students are more likely to feel positive about their

education and career choices. Additionally, in high school, BMS career exploration coursework has been an established pipeline for improving the lives and circumstances of Hispanic and underrepresented minority students. These students play an important role and make a permanent and lasting impact on the quality of the STEM workforce (Mulvey et al., 2022). There is also potential for introducing career skills earlier to bring more attention and excitement to an area that Hispanic in BMS-healthcare career areas. At the community level, this study may also contribute to the gaps in the BMS and healthcare industry providing a variety of necessary services.

Career exploration scaffolds and provides numerous learning situations encouraging Hispanic students in skill building and goal setting, as well as making informed decisions about their education, and developing essential life skills. Exposing Hispanic students to middle school BMS career exploration programs can bring more attention and excitement to the BMS and healthcare field. The participants' narratives mentioned the introduction of middle school BMS career exploration programs by more schools and school districts could get Hispanic students more interested in BMS careers. This research emphasizes the need for early exposure and education in STEM subjects to cultivate a lifelong interest with Hispanic students. Additionally, in middle school, STEM programs dramatically boost the interest of Hispanic students who expect to pursue a science career in the future. (Park-Taylor et al., 2022).

This study may have deeper implications moving forward. The information gathered from the data analysis may help accommodate educators, schools, and school districts with better understanding of how middle school career exploration should be

used to excite and engage middle school students to improve learning in the classroom and help them connect their learning and future goals. Another contribution that this study makes is how middle school career exploration programs, such as BMS, may motivate Hispanic students to continue to pursue their interests in BMS and healthcare career areas, and furthermore possibly STEM areas, most importantly Science and Mathematics. Additionally, exposing Hispanic students to BMS career exploration early on could help build confidence in Hispanic students and other underrepresented groups, opening the door to diverse BMS-healthcare career opportunities.

Conclusion

The problem addressed in this study is the limited research on the influence of middle school experiences in BMS career exploration that can encourage Hispanic students to pursue BMS careers. Students can lose the desire to pursue a STEM career in middle school or earlier (Grant et al., 2021). The key findings within this study determined that middle school BMS career exploration promotes student attention and interest. Furthermore, career exploration allows Hispanic students to become engaged in what they are learning while immersing themselves in real-world scenarios through applicable learning. The industry skills learned empowers students, develops awareness while immersing them in real-world scenarios that can build a sense of inner pride and gratification.

The positive response from the participants in this study shows there is a need to implement middle school career pathways for further exploration of BMS careers. Keller's (1983) ARCS model has been used to focus on motivation to learn in relation the

instructional design and teaching strategies. Assessing the students' levels of motivation in high school PLTW BMS pathways offers a deeper understanding of the quality of increasing middle school BMS career exploration opportunities. The teacher participants indicated in their interviews that many of their Hispanic students were actively engaged in the BMS activities, and their attention and engagement continued beyond the classroom. Participants indicated that students took ownership of their learning because they appeared excited, engaged, empowered and successful in what they were doing. A middle school BMS experience can help students relate to industry careers and make those connections with not only the high school PLTW courses but also with their own career interests and future career pathways.

This personal connection is at the heart of relevance. In direct alignment with the relevance, confidence, and satisfaction components of the ARCS model, middle school students would see the significance and meaning behind what they're learning in a middle school class and possibly something to look forward to in high school. Students can see the success they can have and build more trust in their learning while they're still in school. Finally, because of the positive outcomes of attention, relevance, and confidence, the first three components of the ARCS model, the outcome of the data from the study participants resulted in overall satisfaction with the students' learning process.

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Appendix: Alignment of the Interview Protocol With Keller's (1987) Attention, Relevance, Confidence, and Satisfaction Model

	Interview question	Attention	Relevance	Confidence	Satisfaction
1.	How would you describe your students' experiences with PLTW and career relatability in your classroom?		X		
2.	Give me an example of a time when PLTW created an experience that was unique from activities and lessons that could not be found in a general science classroom.		X		
3.	Share some examples of how student's experiences from the career exploration in your curriculum positively impact their learning in your BMS classes.	X	X	X	X
4.	Share some components of your BMS course you find that your students understand better because of the career exploration experiences.	X	X	X	X
5.	Talk about one lesson of the PLTW BMS curriculum you think your students enjoy that is directly linked to the career exploration in your classes.	X	X	X	X
6.	Talk about one aspect of the BMS course, you feel your students are better prepared for that is directly linked to the career exploration experiences discussed.	X	X	X	X
7.	Thinking about your students' PLTW BMS experiences, tell me a story about when you could tell students were engaged with their lesson or experience because of the career exploration relatability	X	X	X	X
8.	How is student engagement different for those in your BMS classes after exploring	X	X	X	X

	Interview question	Attention	Relevance	Confidence	Satisfaction
	careers than those who do not have those experiences in a traditional science class?				
9.	Talk about how career exploration opportunities help your students take ownership of their learning in and out of your classes.	X	X	X	X
10.	Talk about your students growth and confidence because of the career exploration relatability in your BMS classes.		X	X	
11.	Thinking about your students' PLTW BMS experiences, give me some scenarios of how your students would benefit from beginning career exploration in middle school before starting the PLTW BMS pathway in high school?	X	X	X	X